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LOWELL, MASS

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Effect of Twist on Cotton Yarn Diameter

By Gilbert R. Merrill, B.T.E.*

This bulletin is based on a short study used as a thesis by Vernon L. Wilkinson as part of the requirements for a diploma in Cotton Manufacturing. The time available for undergraduate theses is quite limited and such students are relatively inexperienced in research studies. Consequently, this study was limited to two counts. Its use in this bulletin is to propose to those interested that the diameter of a yarn varies with the amount of twist inserted.

Many items in spinning and weaving are based on the diameter of the yarns. In spinning, the commonly used lay is calculated at about one third of the maximum coils per inch. In winding, the setting of the slub catcher is governed by the diameter of the yarns being wound. In weaving, designers calculate the maximum number of ends or picks which may be laid side by side in one inch and then lay out the fabric by modifying this as desired. Plain weaves and sateens would, obviously, be different. Materials such as duck, balloon cloth or Shirley fabric, each present a different problem. However, in each case, the diameter of the yarn is an important item in the fabric structure.

Considering how frequently yarn diameter must have been of interest to the industry, it is surprising how little data is available on the subject. The basic formula which has been used for many years is

$$\text{Yarn Diameter} = \frac{1}{\sqrt{\text{yards per pound}}}$$

Apparently finding that this formula did not give quite the correct figure, several attempts have been made to modify it. Wakefield[1] gives the form

$$\text{Yarn Diameter} = \frac{1}{\sqrt{\text{yards per pound}}} - 10\%$$

which would probably be written today as

$$\text{Yarn Diameter} = \frac{.9}{\sqrt{\text{yards per pound}}}$$

This may be further simplified by removing 840 from the radical sign to give

$$\text{Yarn Diameter} = \frac{.0311}{\sqrt{\text{counts}}}$$

Wakefield also quotes Ashenhurst's formula, which seems to be the most generally used at the present time, as

$$\text{Yarn Diameter} = \frac{1}{\sqrt{\text{yards per pound}} \quad - 10\%}$$

This would probably be written today as

$$\text{Yarn Diameter} = \frac{1}{.9\sqrt{\text{yards per pound}}}$$

or in its simplified form

$$\text{Yarn Diameter} = \frac{.0383}{\sqrt{\text{count}}}$$

Taggart[2] gives the formula for yarn diameter as

$$\text{Yarn Diameter} = \frac{.0278}{\sqrt{\text{counts}}}$$

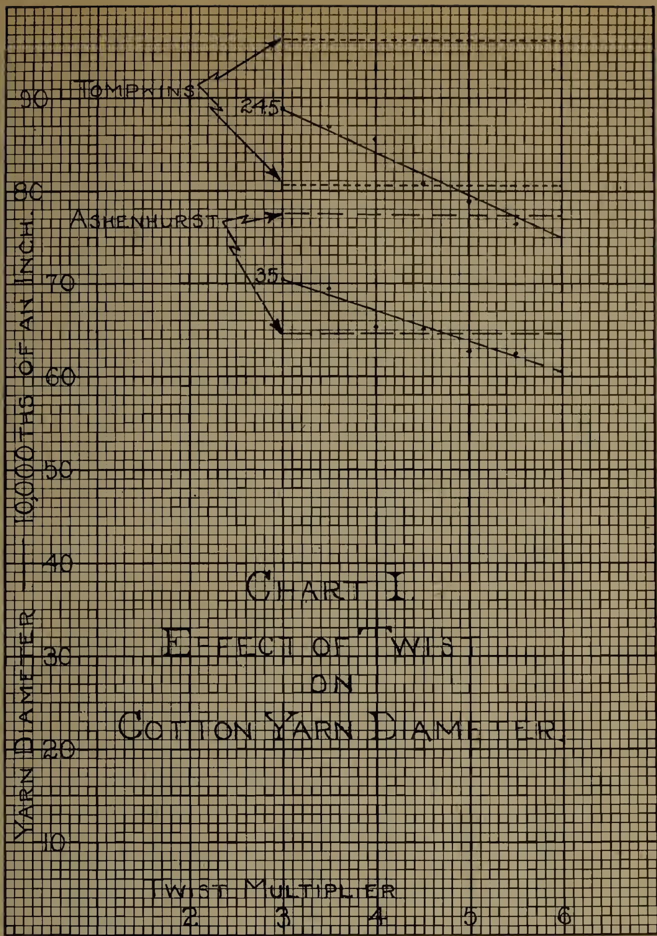
Tompkins[3] recognizes that knitting yarns are soft and full, and gives the formula for cotton knitting yarn as

$$\text{Yarn Diameter} = \frac{1}{21\sqrt{\text{counts}}}$$

This in the simplified form would be

$$\text{Yarn Diameter} = \frac{.0476}{\sqrt{\text{count}}}$$

*Professor of Textiles — In Charge of Department of Cotton Yarns and Knitting, Lowell Textile Institute


Tompkins
24.5
Ashenhurst
35
90
80
70
60
50
40
30
20
10
Yarn Diameter — 10,000ths of an Inch.
Chart I.
Effect of Twist
on
Cotton Yarn Diameter.
Twist Multiplier
2
3
4
5
6

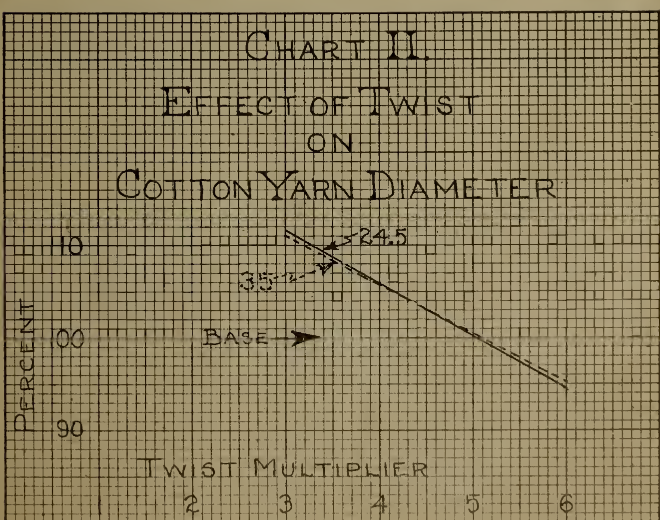


Chart II.
Effect of Twist
on
Cotton Yarn Diameter
24.5
35
110
100
90
Base
Percent
Twist Multiplier
1
2
3
4
5
6

Summarizing these formulae in the simplified form gives the following comparison of the constants which are divided by the square root of the count

Old Rule	.0345
Wakefield	.0311
Ashenhurst	.0383
Tompkins	.0476
Taggart	.0278

Tompkins differs radically from the other formulae, indicating a recognition of the softer twist in knitting yarns. Taggart differs from the others less radically but in the opposite direction, with no details to explain why his figure is quite so different.

Accepting the theory that different amounts of twist should vary the diameter of the yarns of the same count, for which no accepted rule or modifiers of rules were available, this study was made to see what could be shown about the effect of twist on yarn diameters.

From previous studies, samples of 24.5s and 35s were available. These were spun with multipliers ranging from 3 to 6, in increments of .5. The yarns were carded upland.

Measurements for diameter were made with an ocular micrometer in a standard microscope, using a magnification of 100 times. A special assembly of yarn guides and tensions was arranged so that the yarn diameters were taken while the yarns were suspended without contacting anything, thus avoiding the flattening which might result from a contact with the microscope stage.

The summary of the data collected on diameters is shown in the table below. Each average is obtained from fifteen readings each from eight different skeins, giving a total of 120 readings.

Summary

Yarn Diameters in Ten Thousands of an Inch

Counts Spun	Multipliers Used							Ashenhurst's Diameter
	3.00	3.50	4.00	4.50	5.00	5.50	6.00	
24.5	88.8	86.9	85.6	80.7	78.8	76.3	75.0	77.5
35.0	70.2	69.3	65.2	65.1	62.7	62.3	60.6	64.7

The figures of the summary were plotted on Chart I to show the trend of the effect of twist on diameter. For ready comparison, horizontal lines indicate the positions for Ashenhurst's and Tompkins' diameters. Tompkins' figures seemed to be greater than the diameters for yarns with a 3.00 multiplier. Even if the Wilkinson lines were extended, Tompkins' figures would not meet them within any practical multiplier.

Judging from Chart I, Wilkinson's figures seem to agree with Ashenhurst's figures at about the twist multiplier of 5.00. Using this as a basis and calling Wilkinson's diameters for a 5.00 multiplier a base, two lines were drawn on Chart II representing the lines of Chart I as percentages of the base diameter.

The two lines of Chart II agree very closely and seem to indicate the relationship of multiplier to change-of-diameter is reasonably independent of count. The slope of these lines averages approximately

$$\text{Per Cent Change in Diameter} = .055 \times \text{Change in Multiplier}$$

If this data is correct, then the Ashenhurst formula for yarn diameter may be modified to allow for different twist multipliers. Using the above rate of change, Ashenhurst's formula would be modified as follows

$$\text{Yarn Diameter} = \frac{.0383}{\sqrt{\text{counts}}}\ (1.275 - .055 \times \text{Multiplier})$$

Example. What would be the diameter of a 30^s filling yarn using a multiplier of 3.50?

$$\text{Yarn Diameter} = \frac{.0383}{\sqrt{30}}\ (1.275 - .055 \times 3.50)$$

$$= \frac{.0383}{5.48}\ (1.275 - .1925)$$

$$= (.0070)\ (1.0825)$$

$$= .0076 \text{ inches}$$

(*NOTE.* While this data indicates changes of diameter are independent of count, the author of this bulletin feels that research over a wide range of counts may show slight differences in the rate of change from coarse to fine yarns.)

[1] A Preliminary Investigation Concerning the Diameters of Yarns. Sam Wakefield. "Textile Mercury" Monograph — No. 2, Nov. 17, 1914, Marsden & Co., Ltd., Manchester, England.

[2] Cotton Spinning, Vol. III. Wm. Scott Taggart. MacMillan & Co., Ltd., London, England, 1925.

[3] The Science of Knitting. Ernest Tompkins. John Wiley & Sons, Inc., New York, 1914.

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BULLETIN

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The Relationship of Twist to the Strength and Length Shrinkage of a Woolen Yarn

By Henry L. Pero, B.T.E.
Instructor in Wool Department

The purpose of this bulletin is to present the results of a study made to establish a relationship between twist, strength and length shrinkage in a woolen yarn. The study was made under the direction of Professor Herbert J. Ball, in charge of the Department of Textile Engineering. The work was presented in the form of a thesis as a partial requirement for the degree of Bachelor of Textile Engineering.

Twist is undoubtedly the greatest single variable affecting the strength of any staple fibre yarn. In the case of woolens and worsteds it is also believed to affect the length shrinkage in scouring and finishing operations. It was the purpose of this study to establish for a given yarn and blend, the relationship between these factors.

The underlying theory of how twist gives strength to a staple fibre yarn and how it affects length shrinkage during scouring is explained as follows:

Strength—When fibres are twisted together in the formation of a yarn a compression results, due to the crowding together of the fibres. The greater this compressive force, the greater the surface friction becomes between the individual fibres. This surface friction tends to increase the tensile strength of the yarn.

However, as the fibres are twisted about their axes, there also develops an internal shearing stress which tends to reduce the tensile strength of the fibre. This internal stress may be considered analogous to that set up in an iron or steel bar when twisted. Thus this shearing stress tends to offset partially the beneficial effect of surface friction, and with increasing twist we may expect to find a point beyond which further increase of twist will cause the tensile strength of the yarn to be reduced.

Length Shrinkage—The detergent action of soaps and alkalies used in scouring penetrates between and beneath the scales of the epidermal structure of the wool fibre. The action of the detergents is to remove natural oils and greases, thus allowing the overlapping scales to work closer together and consequently cause a decrease in the length of the fibre. The theory here applies to length shrinkage rather than to shrinkage caused by the phenomenon of wool felting. Just where length shrinkage ends and felting of the fibre begins has not been definitely determined.

The more the fibres, in the form of a yarn, are twisted the more difficult it may become for detergent action to penetrate between the scales of the surface to remove these natural greases. We should then expect less shrinkage in yarns having higher twist and more in yarns of lower twists.

A 2¾ run yarn was made from a blend of stock chosen to spin well with a wide range of twist. The blend selected was 75% of mixed staple ⅜s-½s and fine blood clothing wool and 25% of worsted card waste and burr waste. It was processed on a standard 3-cylinder tape condenser card which delivered a roping weighing 95 grains per 50 yards. The latter was spun on a 120-spindle mule. Seven lots of yarn were made having twist variations from 4.16 to 19.74 tpi as per Table II.

For the twist and strength tests, 30 bobbins were selected at random from each lot. Four twist determinations were made for each bobbin. One 50-yard skein was prepared from each bobbin for determination of yarn number and skein breaking strength. Due to the unavoidable variations in yarn number the strengths have been put on a comparable basis by use of the strength index. This figure is the product of the actual yarn number and the breaking strength in pounds.

For the shrinkage tests, 30 more bobbins were selected at random from each lot and a 50-yard skein was prepared from each. It was first necessary to set up a base length of the skeins for each lot. For this a board about 20″ x 20″

was prepared. Pins were provided at the top of the board from which skeins could be suspended under a known constant weight. The weight, determined by experiment as that necessary to remove all initial crimp without producing undue strain on the yarn, was found to be 30 ounces. To this weight was affixed a pointer to record the length of the skeins on sheets of graph paper attached to the board. The base length for all lots except the last was found to be 17.0". The last lot had a base length of 16.9". Each skein was suspended with the weight and allowed to hang for ¼ minute before the length was recorded.

For the scouring of the skeins of yarn, baths were prepared as shown in Table I.

Table I

Tub	Water Volume (Liters	Soda Ash (Ounces)	Soap (Ounces)	Temp. (°F)
1	20	2.1	0.7	125
2	20	1.4	1.4	120
3	20	0.7	2.1	115
4	20	0	0	110

The skeins of each lot were placed in a wire mesh basket and successively immersed in the scouring solution of each tub for 3 minutes. The basket was moved slowly, care being taken not to cause any violent agitation. After removal from each tub the skeins were run back and forth through squeeze rolls to obtain maximum flushing of the excess water. The skeins were then air dried in a standard atmosphere and measured for length.

A summary of all data obtained is given in Table II and expressed in graphical form in Figs. 1 and 2.

Table II

Summary of Results

Lot No.	T.P.I. Actual	T.P.I. Coef. Var.	Strength of 50 yd. skeins Lbs.	Strength of 50 yd. skeins Coef. Var.	Actual Yarn Number	Strength Index	Shrinkages of 50 yd. skeins Inches	Shrinkages of 50 yd. skeins %	Shrinkages of 50 yd. skeins Coef. Var.
1	4.16	9.28%	14.11	12.96%	2.87	40.5	0.712	4.18	14.19%
2	6.32	8.48	22.40	19.95	2.88	64.5	0.496	2.92	29.00
3	8.24	8.11	32.27	9.38	2.76	89.0	0.503	2.96	27.81
4	10.63	7.73	40.91	5.35	2.58	106.0	0.351	2.06	39.10
5	12.58	6.14	40.23	7.48	2.66	107.0	0.238	1.40	50.80
6	16.65	10.60	40.47	7.09	2.54	103.0	0.189	1.10	57.68
7	19.74	3.87	41.31	5.84	2.45	101.0	0.172	1.02	58.38

Examination of the above data discloses that the 2¾ run woolen yarn conforms with the expressed theory on twist-strength relationship for a staple fibre.

The strength index increases at the rate of nearly 10 units for each tpi increase of twist until the critical point is reached. At this point, approximately 11 tpi, the relationship reverses and the strength decreases at the rate of nearly 1 unit for each 1 tpi increase of twist.

The length shrinkage decreases with increase of twist, the increment of decrease per tpi becoming smaller as the twist becomes greater. The critical point on the twist-shrinkage curve is reached at approximately 16 tpi. This would indicate that for minimum appreciable shrinkage it will be necessary to increase twist from 11 to 16 tpi to produce a yarn of near maximum strength with minimum length shrinkage.

The coefficient of variation of twists shows a trend in which the coefficient decreases at a non uniform rate from 9.28% in the first lot to 3.87% in the last lot.

The coefficient of variation of the strength of skeins shows a trend in which the coefficient decreases at a non-uniform rate from 12.96% in the first lot to 5.84% in the last lot.

A study of the coefficient of variation in the shrinkage determinations disclosed that the standard deviation of the lengths of the skeins was large and substantially constant from lot to lot. This fact, coupled with the steadily decreasing value of the mean shrinkage, caused the increasing and high values of the coefficient.

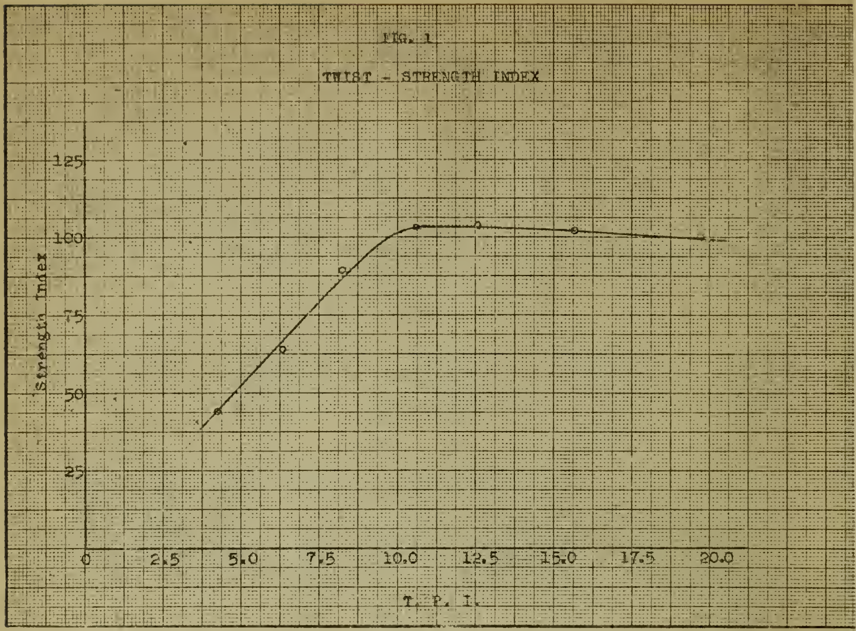
FIG. 1
TWIST - STRENGTH INDEX
Strength Index
125
100
75
50
25
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
T. P. I.

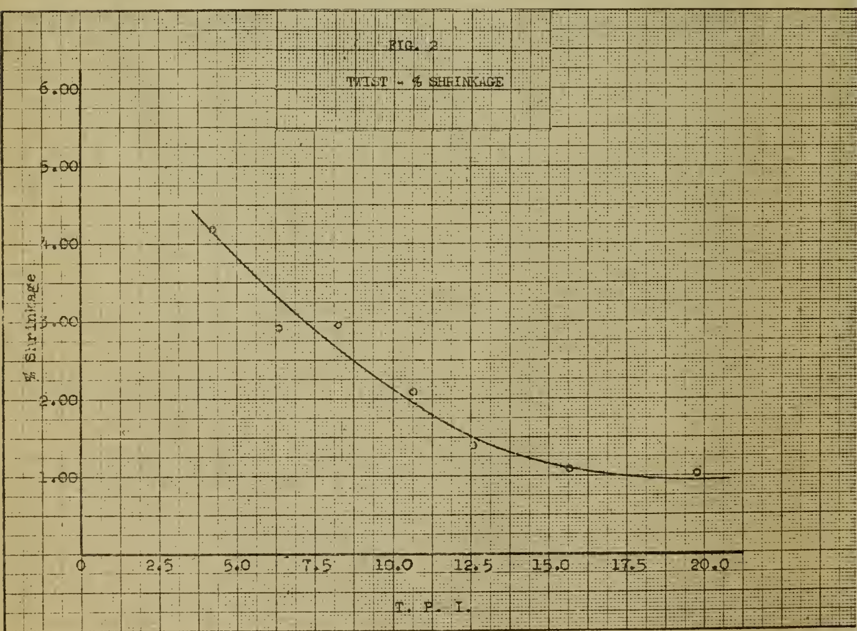
FIG. 2
TWIST - % SHRINKAGE
% Shrinkage
6.00
5.00
4.00
3.00
2.00
1.00
0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
T. P. I.

Southwick Hall　　　　Louis Pasteur Hall

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Christmas recess	December 23–January 3
First semester examinations begin	January 13
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1947–1948

(first semester)

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Re-examinations	September 8–12
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Classes begin for Freshmen	September 15
Classes begin for upper-class students	September 16
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Armistice Day — Holiday	November 11
Thanksgiving recess	November 20–21
Christmas recess	December 22–January 2
First semester examinations begin	January 12
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Ruth Foote, ex officio	1948

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	Term Expires
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C. L. Daley	1946
Horton Brown	1947

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	Term Expires
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P. D. Petterson	1947
C. L. Howarth	1948

HISTORICAL SKETCH OF THE LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its method of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space.

The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The courses for those students who can attend the day classes are organized to prepare them to enter some one of the various branches of the textile industry. It is required that all such students shall have an educational background equivalent to that of a complete college preparatory course as given by a recognized high school or academy. These textile courses are of four years duration and are described in detail on the following pages of this catalogue.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool

yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three story addition was placed on a single story building that was previously known as the Colonial Avenue Building which was erected in 1910. This Hall contains on the first floor the Cotton Finishing laboratory with class rooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry and Textile Coloring Department.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will, it is hoped, be further improved to make a modern campus for baseball and other sports.

GENERAL INFORMATION

Application for Admission. — A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration. — Each freshman is expected to be in daily attendance beginning Thursday, September 12, at 9.30 a.m., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration. — All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions. — The regular school sessions are in general from 8.30 a.m. to 12.20 p.m., and from 1.30 to 4.00 p.m., except Saturdays, when no classes are held.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance. — Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their in-

structors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

ADVISERS. — Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

CONDUCT. — Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

EXAMINATIONS. — Examinations will be held during the eighth week of each term and final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

RECORDS AND REPORTS OF STANDING. — During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

LIBRARY AND READING ROOM. — That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical

books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

The Chemistry and Dyeing Department also has a library supplied with books and periodicals which pertain to chemistry in general and textile chemistry and dyeing in particular.

FEES, DEPOSITS, ETC.

Tuition Fee. — The fee for the day course is $150 per year for residents of Massachusetts, and $250 per year for non-residents. The fee for students from foreign countries is $500 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee. — An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits. — Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Board and Rooms. — Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials. — Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (foreigners)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop).	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

DEGREE COURSES

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Board or by the Board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

REQUIRED SUBJECTS

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	12

ELECTIVE SUBJECTS

	Points
Elementary French (two years) or–	2
Elementary German (two years) –	
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanics Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

DIPLOMA COURSES

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects. These courses are discontinued starting with September 1946.

REQUIRED SUBJECTS

	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English	1
Physics	1
Chemistry	1
	10

ELECTIVE SUBJECTS

Three may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows: —

Thursday, June 6, 1946; Tuesday, September 10, 1946; Thursday, June 5, 1947: —

Algebra, 9 A.M. to 11 A.M.
History, 11 A.M. to 1 P.M.
English, 2 P.M. to 4 P.M.

Friday, June 7, 1946; Wednesday, September 11, 1946; Friday, June 6, 1947: —

Plane Geometry, 9 A.M. to 11 A.M.
German or French, 11 A.M. to 1 P.M.
Chemistry, 11 A.M. to 1 P.M.
Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

ALGEBRA A1. — Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

ALGEBRA A2. — Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

PLANE GEOMETRY. — The usual theorems and constructions of good text-books, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

CHEMISTRY. — Requirements are those of the New England College Entrance Board, or the Board of Regents of New York, including personal laboratory work. Those not meeting the requirements by school or college certificate will be subject to written examination.

ENGLISH. — As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

HISTORY. — Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an

elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted

PHYSICS. — The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

MODERN LANGUAGES. — Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

ELEMENTARY GERMAN A. — The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

ELEMENTARY FRENCH A. — The entrance examination is composed of two parts, both taken, however, at the same time.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

HISTORY. — If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

SOLID GEOMETRY. — The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

TRIGONOMETRY. — The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

MECHANICAL DRAWING. — The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

MECHANICS ARTS. — The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

ELEMENTARY FRENCH B. — Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

ELEMENTARY GERMAN B. — Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

ADVANCED FRENCH OR GERMAN. — In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

SPANISH. — Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

LATIN. — Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

DEGREE COURSES. — The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.
Synthetic Textiles.

At the completion of these courses the degrees of Bachelor of Science in the various courses are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

DIPLOMA COURSES. — The following discontinued courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COEDUCATIONAL

Within the last few years the possibilities for women in certain branches of the textile field have become recognized and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some who choose the Textile Engineering Course with the design option, for it offers a broad training that prepares for many lines of activity. For those who wish to specialize in textile designing and art, The Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry and Textile Coloring Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the

object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students are the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements. All courses both undergraduate and graduate are open to women.

PHYSICAL EDUCATION AND ATHLETICS

Through competition in athletics and through instruction in classes in physical education the Department of Physical Education attempts to balance the intellectual and mental progress of the students by developing proper health habits, by promoting better physical development, and by inspiring high ideals of sportsmanship.

Physical education and athletics are under the supervision of the Head of the Physical Education Department, who is also Faculty Director of Athletics.

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

ATHLETIC ASSOCIATION

All students, by virtue of payment of the student athletic tax, are members of the Athletic Association and are represented by an executive council of sixteen, consisting of the president and athletic representative from each of the four classes, the captains and managers of the three varsity sports, and one representative each from the Pickout and the Textile Players. This Council acts as an ad-

visory body to the Athletic Director, has charge of social and athletic events run by the Athletic Association, and ratifies the awarding of letters and appointment of student managers in the various sports.

The schedules of all sports are arranged with the interest of both the Institute and the individual members of the teams in mind. Admission to all home contests is included in the athletic fee which is paid by each student at the time of registration.

Teams are regularly maintained in varsity football, basketball, and baseball. Recently Textile has been represented by tennis and golf teams and by a junior varsity basketball team. Intramural competition is provided by interclass and interfraternity competition.

ALUMNI ASSOCIATION

The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1945–46

Carl D. Brandt, '20, *President*
J. Milton Washburn, '21, *Vice-President*
A. Edwin Wells, '20, *Secretary-Treasurer*

Communications should be addressed to A. Edwin Wells, Lowell Textile Institute.

Executive Committee

Roy H. Bradford, '06	Milton Hindle, '25
Harold E. Clayton, '21	Thomas Joy, '26
James F. Dewey, '04	Francis P. Madden, '13
Parker F. Dunlap, '34	Richard W. Rawlinson, '31
John G. Echmalian, '16	Everett B. Rich, '11
Edwin D. Fowle, '24	Raymond R. Stevens, '19
Olin D. Gay, '08	Herbert W. Wilkinson, Jr. '37

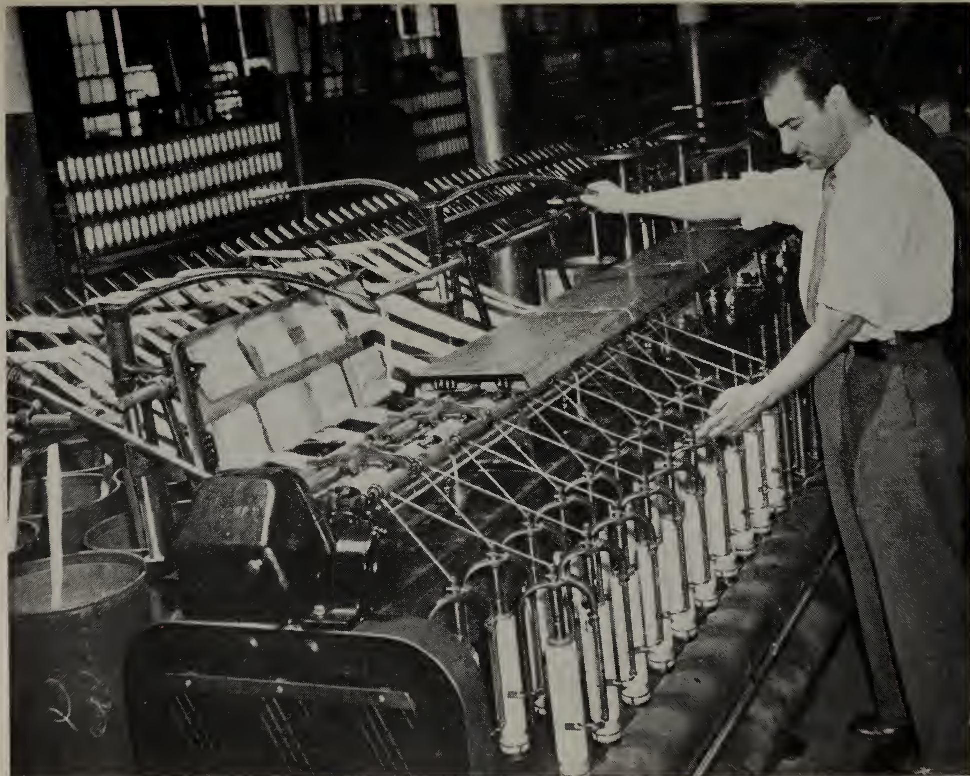
J. Milton Washburn, '21

Trustees of the Scholarship Funds

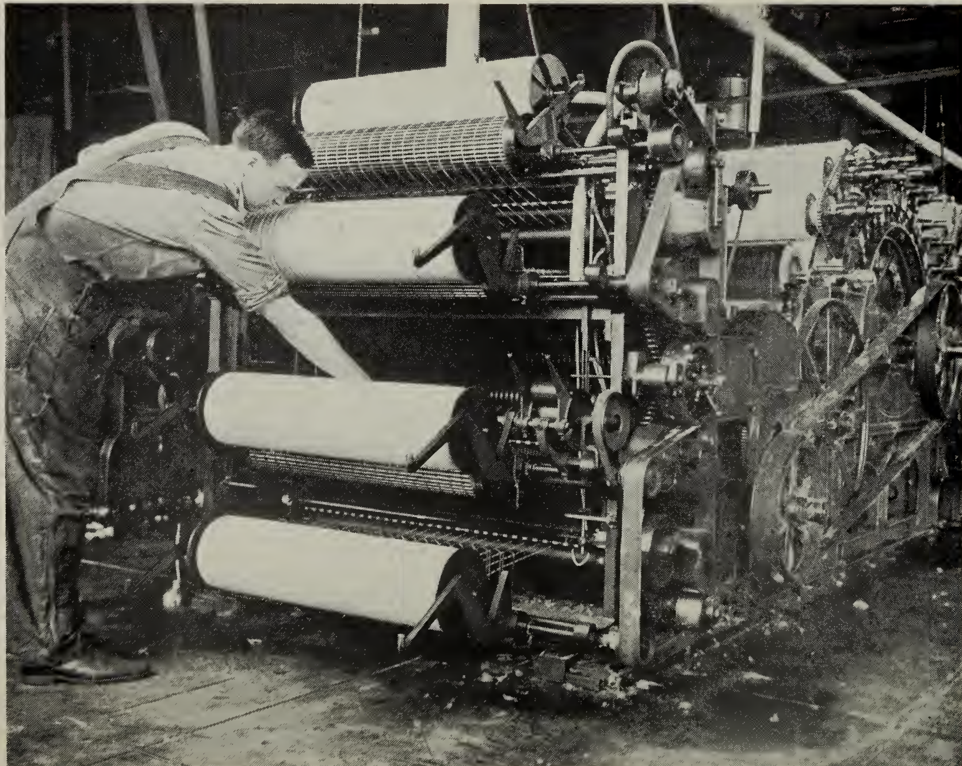
Carleton J. Lombard — Albert J. Gilet

Auditor

Nathaniel E. Jones



SUPERDRAFT ROVING FRAME



WOOLEN CARD

CURRICULUM

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 40.

The departments are indicated as follows: —

Textile Engineering	B	Cotton and Knitting	F
Chemistry and Textile Coloring	C	Wool and Worsted	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year. First Term. (Common to All Courses)

	Hours of Exercise
Elementary Inorganic Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course V-VI
Elementary Inorganic Chemistry C–10	45	45
Elementary Organic Chemistry C–11	30	30
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–12 or C–12a	150	45
Stoichiometry C–13	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses, I, II, and III, see pages 25, 27, 29.

COURSE I.—COTTON MANUFACTURE

The Cotton Manufacturing Course is intended for students contemplating a career in the manufacture of yarns or fabrics of cotton or the new synthetics processed after the methods used for cotton. As over eighty per cent of the textile fibers consumed in the United States is cotton, it is the policy of the Cotton Department to give the student a thorough course of instruction in handling cotton first. Later, the adaptation of cotton machinery to handle rayon, wool or other fibers is carefully covered. Throughout the work on cotton carding and spinning, reference is made to the possibilities of handling the various rayons, wools or mixes and usually one or more small lots are processed in the laboratory.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

The instruction in cotton carding given in the second year covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop with particular emphasis given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Lectures supplement the material available in specially prepared text books. This makes possible instruction regarding the very newest developments in the industry as well as for standard methods and equipment. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 40.

COURSE I.—COTTON MANUFACTURE

[For first term see page 23]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	45
Elementary Organic Chemistry C–11	30
English E–10	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–12a	45
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Chemical Technology of Fibers C–20	20
Color D–23c	15
Cotton Carding F–20	210
Cottons F–22	15
Physics B–23a	45
Power Weaving D–24	75
Steam Engineering B–24	45
Textile Chemistry and Dyeing Lect. C–21	10
Textile Design and Cloth Construction D–20	90

Second Year. Second Term

Cotton Carding F–21	195
Cotton Waste Processing F–23	30
Physics B–23a	45
Power Weaving D–24	135
Textile Chemistry and Dyeing Lect. C–21	30
Textile Design and Cloth Construction D–20	90

Third Year. First Term

Cotton Finishing H–31	75
Cotton Quality Control F–32	15
Cotton Spinning F–30	135
Electricity B–31a*	30
Mill Engineering B–34a*	30
Mill Organization F–34	60
Power Weaving D–32	165
Staple Fiber Manufacture F–33	15
Textile Testing B–43a	30
Thesis F–36	

Third Year. Second Term

Cotton Finishing H–31	75
Cotton Winding and Twisting F–31	225
Knitting FK–30	105
Power Weaving D–32	120
Thesis F–36.	

* Not given in 1945–46.
This course discontinued in September 1946.

COURSE II.—WOOL MANUFACTURE

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 40.

COURSE II.—WOOL MANUFACTURE

[For first term see page 23]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	45	Mathematics B–10	60
Elementary Organic Chemistry C–11	30	Mechanism B–12	60
English E–10	45	Physical Education	30
Machine Drawing B–13	135	Qualitative Analysis C–12a	45
		Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Chemical Technology of Fibers C–20	20	Steam Engineering B–24	45
Fiber Preparation G–20	105	Textile Chemistry and Dyeing Lect. C–21	10
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	90	Top Making G–21	135

Second Year. Second Term

Color D–23w	15	Textile Chemistry and Dyeing Lect. C–21	30
Fiber Preparation G–20	120	Textile Design and Cloth Construction D–21	75
Physics B–23a	45	Top Making G–21	120
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a*	30	Woolen and Worsted Finishing H–30	75
Mill Engineering B–34a*	30	Woolen Yarn Manufacture G–30	105
Power Weaving D–32	105	Worsted Yarn Manufacture G–31	180
Textile Testing B–43a	30		

Third Year. Second Term

Knitting FK–30	105	Woolen Yarn Manufacture G–30	105
Power Weaving D–32	135	Worsted Yarn Manufacture G–31	105
Woolen and Worsted Finishing H–30	75	Thesis.	

* Not given in 1945–46.

This course discontinued in September 1946.

COURSE III. TEXTILE DESIGN

The course in textile design is a three-year diploma course intended for men and women who are attracted by the possibilities in a career designing fabrics. The field is a varied one and includes opportunities for those who desire positions designing staple fabrics, novelty fabrics, elaborate fabrics as well as new combinations for fabrics of great appeal.

A textile designing position is probably one of the most comprehensive positions in the textile industry. The designer's fabric layout is the result of careful reasoning and must include understanding of yarn, weave, weight, finish and wearing qualities. The designer who finds his greatest interest in one of the simplest outlets, such as sheeting, must employ sound judgment in his choice of yarn, closeness of weave and wearing qualities to appeal to public demand. If, on the other hand, the designer inclines toward more elaborate fabrics, such as those fabrics employing many colors, fancy weaves, or combined weaves to bring out a surface pattern, his opportunity for creative expression increases with the intricacy of the fabric in question. A classification of similar fabrics into types would show a number of interesting positions for designers to meet with varying creative ability.

The curricula of the Design Course has been planned so as to supply the student with knowledge and skill to make him an essential individual in the designing field. Approximately sixty-five per cent of the subjects are concerned directly with fabric designing and include both the structural and the decorative. His technical training includes all types of fabric construction and is enhanced by his training in decorative art. The latter has been carefully planned to include subjects which train the student along this line in a systematic manner and which are pertinent to textiles.

A complete list of subjects by terms will be found on page 29. This course includes subjects from every department in the school that are essential to the training of a competent designer.

For detailed description of the subjects see page 40.

COURSE III.—TEXTILE DESIGN

[For first term see page 23]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	45
Elementary Organic Chemistry C–11	30
English E–10	45
Hand Loom Weaving D–11	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education (boys) Women in Industry (girls)	30
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Chemical Technology of Fibers C–20	20
Color D–23	30
Drawing D–27	30
Microscopy B–41	60
Perspective D–26	30
Physics B–23a	45
Power Weaving D–24	135
Textile Chemistry and Dyeing Lecture C–21	10
Textile Design and Cloth Construction D–20, 21	165

Second Year. Second Term

Color D–23	45
Drawing D–27	45
Fiber and Yarn Identification D–28	45
Knitting FK–30a	30
Physics B–23a	45
Power Weaving D–24	135
Principles of Design D–29	45
Textile Chemistry and Dyeing Lect. C–21	30
Textile Design and Cloth Construction D–20, 21	105

Third Year. First Term

Cotton Finishing H–31	75
Power Weaving D–32	75
Textile Design and Cloth Construction D–30, 31	135
Textile Design and Cloth Construction D–40, 41	75
Textile Marketing B–42*	30
Textile Styling D–35	30
Textile Testing B–43a	30
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Cotton Finishing H–31	75
Jacquard Design and Weaving D–34	90
Power Weaving D–32	120
Textile Design and Cloth Construction D–30, 31	75
Textile Design and Cloth Construction D–40, 41	90

* Not given in 1945–46.
This course discontinued in September 1946.

COURSE IV. CHEMISTRY AND TEXTILE COLORING

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.S., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced organic chemistry is studied during the second and third year as a continutation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. Much time is spent in the organic chemistry laboratory, particularly attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, textile testing, and chemical engineering, as applied to textiles. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 40.

COURSE IV.—CHEMISTRY AND TEXTILE COLORING

[For first year see page 23]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Advanced German E–21	45	Power Weaving D–25	15
Chemical Technology of Fibers C–20	20	Quantitative Analysis C–24	128
English E–20	30	Stoichiometry C–25	15
Mathematics B–20a	60	Textile Chemistry and Dyeing Lab. C–22	105
Organic Chemistry C–23	30	Textile Chemistry and Dyeing Lect C–21	10
Physics B–23	67		

SECOND YEAR. SECOND TERM

Advanced German E–21	45	Stoichiometry C–25	15
Organic Chemistry C–23	30	Textile Chemistry and Dyeing Lab. C–22	135
English E–20	30	Textile Chemistry and Dyeing Lect. C–21	30
Physics B–23	67		
Quantitative Analysis C–24	173		

THIRD YEAR. FIRST TERM

Adv. Textile Chemistry and Dyeing Lab. C–32	135	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Quantitative Analysis C–30	150
Economics E–30	45	Technical German C–35	30
Organic Chemistry C–34	15	Woolen and Worsted Finishing H–30	75

THIRD YEAR. SECOND TERM

Adv. Textile Chemistry and Dyeing Lab. C–32	135	Organic Laboratory C–36	45
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Physical Chemistry C–33	45
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

FOURTH YEAR. FIRST TERM

Adv. Textile Chemistry and Dyeing Lab. C–44	90	Microscopy and Photomicroscopy C–45	60
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Organic Laboratory C–41	75
Chemical Textile Testing C–43	75	Quantitative Analysis C–46	15
Colloid Chemistry C–50	30	Report Writing C–47	15
Electives or Thesis C–54	90	Seminar in Business English E–40	30
Industrial Chemistry C–42	30	Textile Marketing B–42*	30

FOURTH YEAR. SECOND TERM

Advanced General Chemistry C–49	30	Chemical Textile Testing C–43	45
Adv. Textile Chemistry and Dyeing Lab. C–44	135	Electives or Thesis C–54	90
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Organic Laboratory C–41	105
Chemical Engineering C–53	45	The Chemistry of Rayon C–51	15
		Technology of Wool Fibers G–40	15
		Textile Literature C–48	30

* Not given in 1945–46.

COURSE V. SYNTHETIC TEXTILES

The course in synthetic textiles is intended for those students who wish to major in the study of synthetic fibers and their manufacture. While much of the content of the course has been given over the past years, this particular arrangement of subjects specializes on rayons, nylons, Aralac and other man-made fibers. The curriculum is laid out to require four years and, upon successful completion of the work, a student will receive the degree of Bachelor of Science (B.S.)

Owing to the fluidity of developments of synthetic fibers, it is expected that some changes will be necessary from time to time to keep subjects properly balanced.

Freshman subjects are those common to other courses majoring in yarn and fabric manufacturing and are intended as a broad foundation for later work.

During the sophomore year the student begins to specialize in courses covering the various synthetic fibers, their preparation for spinning, and the production of woven fabrics. Owing to the chemical nature of synthetic fibers, considerable emphasis is placed on the study of organic chemistry which is taken at the same time that the student is given instruction in dyes and their application. Courses in mathematics and physics provide scientific background for later technical work.

In the junior year, the textile subjects cover spinning, winding, twisting, weaving, and fabric finishing, with a continuation of engineering work, such as electrical and heat engineering. Economics is given during this year to be followed by Marketing in the senior year.

In the senior year, further fabric finishing, mill organization, knitting, textile testing, and microscopy complete the textile subjects. Accounting and business administration courses give the student some fundamental ideas in these fields, while electrical and mill engineering add to the work of the previous years.

For detailed description of the subjects see page 40.

COURSE V.—SYNTHETIC TEXTILES

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Chemical Technology of Fibers C–20	20
Fiber Study C–26	15
Mathematics B–20	60
Organic Chemistry C–22	30
Physics B–23	75
Quantitative Analysis C–24a	30
Synthetic Yarn, Cotton System F-24	45
Synthetic Yarn, Wool System G–22	75
Textile Chemistry and Dyeing Lecture C–21	10
Textile Design and Cloth Construction D–20, 21	165

Second Year. Second Term

Applied Mechanics B–25	45
Mathematics B–20	60
Organic Chemistry C–22	30
Physics B–23	75
Power Weaving D–25	120
Synthetic Yarn, Cotton System F–24	75
Synthetic Yarn, Wool System G–22	90
Textile Chemistry and Dyeing Lecture C–21	30

Third Year. First Term

Applied Mechanics B–30	45
Economics E–30	45
Electrical Engineering B–31	75
Fabric Finishing H–32	75
Heat Engineering B–32	75
Power Weaving D-32	60
Synthetic Yarn, Cotton System F–35	60
Synthetic Yarn, Wool System G–32	90

Third Year. Second Term

Economics E–30	45
Electrical Engineering B–31	75
Fabric Finishing H–32	75
Heat Engineering B–33	90
Mill Engineering B–34	90
Synthetic Yarn, Cotton System F–35	60
Synthetic Yarn, Wool System G–32	90

Fourth Year. First Term

Accounting B–40	45
Fiber Production C–51	30
Electrical Engineering B–44	75
Mill Engineering B–45	75
Mill Organization F–34	105
Textile Marketing B–42	30
Textile Microscopy B–41	60
Textile Testing B–43, and C–43	105
Thesis	

Fourth Term. Second Term

Business Administration B–46	90
Electrical Engineering B–44	75
Fabric Finishing H–32	105
Knitting FK–30	105
Mill Engineering B–45	75
Mill Illumination B–47	45
Thesis	

COURSE VI. TEXTILE ENGINEERING

This course is the four-year general textile course leading to the degree of Bachelor of Science (B.S.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitation and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problems, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has led to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General Option some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 40. The curricula of the several optional courses will be found on pages 35 to 39.

COURSE VI.—TEXTILE ENGINEERING (GENERAL COURSE-G)

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Chemical Technology of Fibers C–20	20
Cotton Carding F–20b	75
Fiber Preparation G–20	60
Machine Drawing B–21	45
Machine Shop B–26	75
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–21	10
Textile Design and Cloth Construction D–22	45
Top Making G–21	60

Second Year. Second Term

Applied Mechanics B–25	45
Cotton Carding F–21b	75
Electives	
Fiber Preparation G–20	45
Machine Drawing B–21	75
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	75
Textile Chemistry and Dyeing Lect. C–21	30
Top Making G–21	45

Third Year. First Term

Applied Mechanics B–30	45
Cotton Spinning F–30b	60
Economics E–30	45
Electives	
Electrical Engineering B–31	75
Heat Engineering B–32	75
Power Weaving D–32	60
Woolen Yarn Manufacture G–30	45
Worsted Yarn Manufacture G–31	45
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Cotton Winding and Twisting F–31b	60
Economics E–30	45
Electrical Engineering B–31	75
Heat Engineering B–33	90
Mill Engineering B–34*	90
Woolen Yarn Manufacture G–30	45
Worsted Yarn Manufacture G–31	45
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Accounting B–40	45
Cotton Laboratory F–40	45
Electrical Engineering B–44	75
Mill Engineering B–45	75
Mill Organization F–34	60
Seminar in Business English E–40	30
Textile Marketing B–42*	30
Textile Microscopy B–41	60
Textile Testing B–43	75
Thesis	

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Electives B–48, or F–45	
Electrical Engineering B–44	75
Knitting FK–30	105
Mill Engineering B–45	75
Mill Illumination B–47*	45
Textile Testing B–43b	45
Thesis	

* Not given in 1945–46.

COURSE VI.—TEXTILE ENGINEERING (COTTON OPTION-C)

[For first year see page 17]

Second Year. First Term. (Hours of Exercise)

Chemical Technology of Fibers C–20	20
Cotton Carding F–20a	165
Cottons F–22	15
Machine Drawing B–21	90
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–21	10
Textile Design and Cloth Construction D–20	90

Second Year. Second Term

Applied Mechanics B–25	45
Cotton Carding F–21a	105
Cotton Waste Processing F–23	30
Machine Drawing B–21	30
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	60
Textile Chemistry and Dyeing Lect. C–21	30
Textile Design and Cloth Construction D–20	90

Third Year. First Term

Applied Mechanics B–30	45
Cotton Quality Control F–32	15
Cotton Spinning F–30a	150
Economics E–30	45
Electrical Engineering B–31	75
Heat Engineering B–32	75
Machine Shop B–26	45
Power Weaving D–32	60
Staple Fiber Manufacture F–33	15

Third Year. Second Term

Cotton Winding and Twisting F–31a	180
Economics E–30	45
Electrical Engineering B–31	75
Heat Engineering B–33	90
Mill Engineering B–34*	90
Power Weaving D–32	45

Fourth Year. First Term

Accounting B–40	45
Cotton Laboratory F–40	45
Electrical Engineering B–44	75
Mill Engineering B–45	75
Mill Organization F–34	60
Seminar in Business English E–40	30
Textile Marketing B–42*	30
Textile Microscopy B–41	60
Textile Testing B–43	75
Thesis	

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Electrical Engineering B–44	75
Knitting FK–30	105
Mill Engineering B–45	75
Mill Illumination B–47*	45
Textile Testing B–43b	45
Thesis	

* Not given in 1945–46.

COURSE VI.—TEXTILE ENGINEERING (WOOL OPTION-W)

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Chemical Technology of Fibers C–20	20	Mathematics B–20	60
Fiber Preparation G–20	105	Physics B–23	75
Machine Drawing B–21	90	Textile Chemistry and Dyeing Lecture C–21	10
Machine Shop B–26	45	Top Making G–21	120

Second Year. Second Term

Applied Mechanics B–25	45	Power Weaving D–24	75
Fiber Preparation G–20	105	Textile Chemistry and Dyeing Lect. C–21	30
Machine Drawing B–21	30	Top Making G–21	105
Mathematics B–20	60		
Physics B–23	75		

Third Year. First Term

Applied Mechanics B–30	45	Woolen and Worsted Finishing H–30	75
Economics E–30	45	Woolen Yarn Manufacture G–30	60
Electrical Engineering B–31	75	Worsted Yarn Manufacture G–31	90
Heat Engineering B–32	75		
Power Weaving D–32	60		

Third Year. Second Term

Economics E–30	45	Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75	Worsted Yarn Manufacture G–31	75
Heat Engineering B–33	90	Woolen Yarn Manufacture G–30	75
Mill Engineering B–34*	90		

Fourth Year. First Term

Accounting B–40	45	Textile Marketing B–42*	30
Electrical Engineering B–44	75	Textile Microscopy B–41	60
Mill Engineering B–45	30	Textile Testing B–43	90
Seminar in Business English E–40	30	Thesis	
Textile Design and Cloth Construction D–21	75		

Fourth Year. Second Term

Business Administration B–46	90	Textile Design and Cloth Construction D–21	75
Electrical Engineering B–44	75	Textile Testing B–43b	45
Knitting FK–30	105	Thesis	
Mill Engineering B–45	75		
Mill Illumination B–47*	45		

* Not given in 1945–46.

COURSE VI.—TEXTILE ENGINEERING (DESIGN OPTION-D)

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Chemical Technology of Fibers C–20	20	Physics B–23	75
Cotton Carding F–20c	60	Textile Chemistry and Dyeing Lecture C–21	10
Fiber Preparation G–20	45	Textile Design and Cloth Construction D–20, 21	165
Mathematics B–20	60	Top Making G–21	45
Perspective D–26	45		

Second Year. Second Term

Cotton Carding F–21c	60	Textile Chemistry and Dyeing Lect. C–21	30
Fiber Preparation G–20	45	Textile Design and Cloth Construction D–20, 21	120
Mathematics B–20	60	Top Making G–21	45
Physics B–23	75		
Knitting FK–21	30		
Power Weaving D–24	60		

Third Year. First Term

Color D–23	30	Textile Design and Cloth Construction D–30, 31	105
Cotton Spinning F–30b	60	Woolen Yarn Manufacture G–30	45
Economics E–30	45	Worsted Yarn Manufacture G–31	45
Knitting FK–31	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	75		

Third Year. Second Term

Color D–23	45	Textile Design and Cloth Construction D–30, 31	75
Cotton Winding and Twisting F–31b	60	Woolen Yarn Manufacture G–30	45
Economics E–30	45	Worsted Yarn Manufacture G–31	45
Power Weaving D–32	105	Woolen and Worsted Finishing H–30	75
Principles of Design D–29	30		

Fourth Year. First Term

Accounting B–40	45	Textile Marketing B–42*	30
Jacquard Design and Weaving D–34	90	Textile Microscopy B–41	60
Mill Organization F–34	60	Textile Styling D–35	30
Seminar in Business English E–40	30	Textile Testing B–43	90
Textile Design and Cloth Construction D–40, 41	75	Thesis	

Fourth Year. Second Term

Business Administration B–46	90	Perspective D–26	45
Cotton Finishing H–31	105	Textile Design and Cloth Construction D–40, 41	90
Jacquard Design and Weaving D–34	120	Textile Testing B–43b	45
Machine Shop Practice B–26	45	Thesis	

* Not given in 1945–46.

COURSE VI.—TEXTILE ENGINEERING (SALES OPTION-S)

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Chemical Technology of Fibers C–20	20
Cotton Carding F–20b	75
Fiber Preparation G–20	45
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–21	10
Textile Design and Cloth Construction D–20, 21	180
Top Making G–21	60

Second Year. Second Term

Cotton Carding F–21c	60
Fiber Preparation G–20	45
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	105
Textile Chemistry and Dyeing Lect. C–21	30
Textile Design and Cloth Construction D–20, 21	105
Top Making G–21	45

Third Year. First Term

Color D–23	30
Cotton Spinning F–30b	60
Economics E–30	45
Power Weaving D–32	75
Principles of Marketing B–35*	45
Textile Design and Cloth Construction D–30, 31	105
Woolen Yarn Manufacture G–30	45
Worsted Yarn Manufacture G–31	45
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Color D–23	45
Cotton Winding and Twisting F–31b	60
Economics E–30	45
Marketing Methods B–36*	60
Power Weaving D–32	30
Statistics B–37*	45
Textile Design and Cloth Construction D–30, 31	75
Worsted Yarn Manufacture G–31	45
Woolen and Worsted Finishing H–30	75
Woolen Yarn Manufacture G–30	45

Fourth Year. First Term

Accounting B–40	45
Principles of Selling and Advertising B–49*	105
Selling Policies B–51*	45
Jacquard Design and Weaving D–34	45
Textile Design D–41	75
Textile Microscopy B–41	45
Textile Styling D–35	30
Textile Testing B–43	75
Thesis	

Fourth Year. Second Term

Business Administration B–46	60
Cotton Finishing H–31	90
Foreign Trade and Economic Geography B–50*	45
Knitting FK–30b	75
Machine Shop Practice B–26	45
Perspective D–25	45
Selling Policies B–51*	45
Spherical Trigonometry and Navigation	45
Thesis	

*** Not given in 1945–46**

SUBJECT DESCRIPTION

TEXTILE ENGINEERING—B

The various options are designated by G, C, W, D, S.

MATHEMATICS—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: spherical trigonometry and application to navigation, graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation and integration of algebraic functions, and applications. [All courses.]

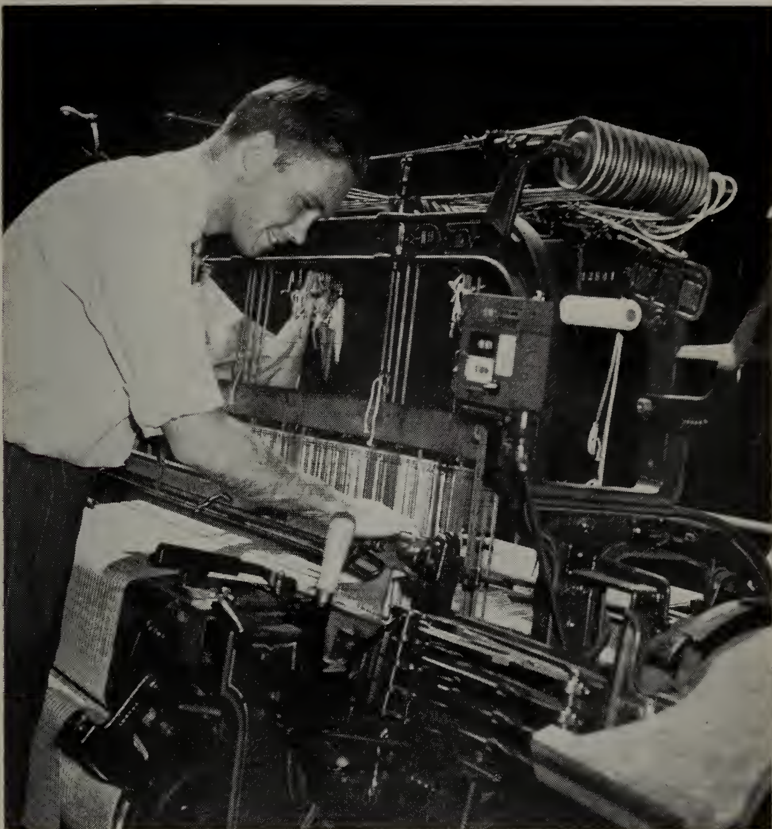
PHYSICS—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

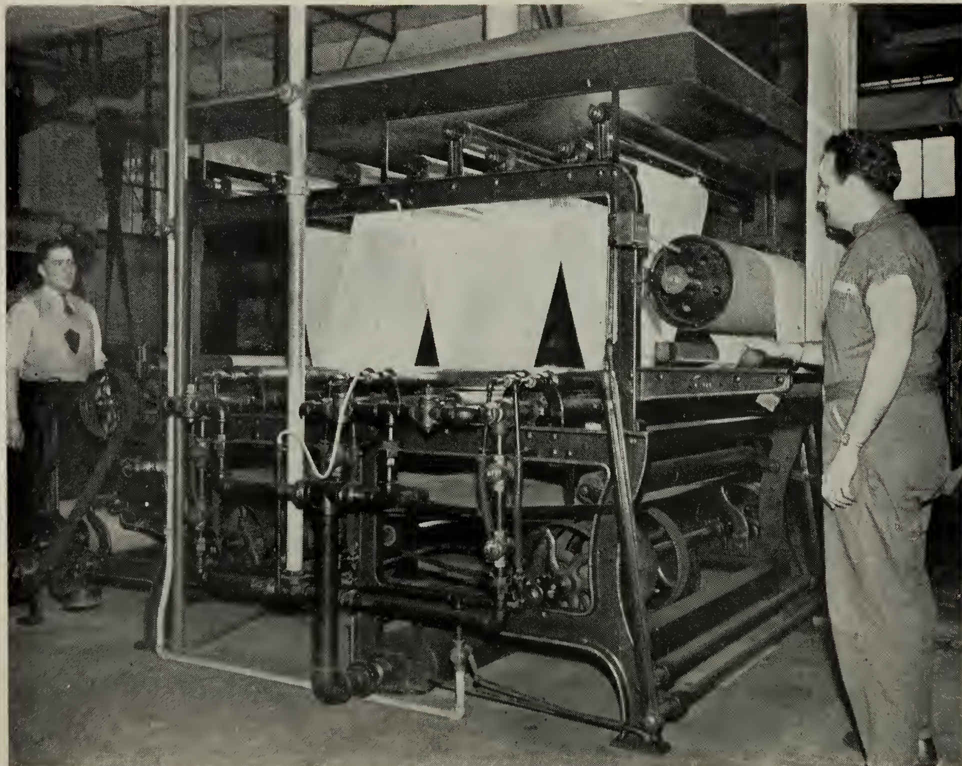
MECHANISM—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.]

MECHANICAL DRAWING—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]



ONE OF THE SIXTY LOOMS



FINISHING A FABRIC

MACHINE DRAWING—B-13a. PREPARATION: ADMISSION REQUIREMENTS. TAKEN SIMULTANEOUSLY WITH B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

MATHEMATICS—B-20. PREPARATION: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—exponential functions, the circle, parabola, ellipse, hyperbola, polar coordinates, indefinite integrals, summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, nomographic charts, and spherical trigonometry and applications. [Course VI.]

MATHEMATICS—B-20a. PREPARATION: B-10. This subject is a continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, trigonometric functions, and spherical trigonometry. [Course IV.]

MACHINE DRAWING—B-21. PREPARATION: B-10, B-12, B-13. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

PHYSICS—B-23. PREPARATION: B-10 AND B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis, electronics.

LABORATORY. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

PHYSICS—B-23a. PREPARATION: B-10 AND B-11. This subject consists of the same topics as B-23 but does not contain any laboratory work. [Courses I, II, III.]

STEAM ENGINEERING—B-24. PREPARATION: B-12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II.]

APPLIED MECHANICS—B-25. PREPARATION: B-11, B-20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity

and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

MACHINE SHOP PRACTICE—B-26. PREPARATION: B-11 AND B-12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

APPLIED MECHANICS—B-30. PREPARATION: B-25. This is a continuation of Applied Mechanics B-25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

ELECTRICAL ENGINEERING—B-31. PREPARATION: B-23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

ELECTRICITY—B-31a. PREPARATION: B-23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

HEAT ENGINEERING—B-32. PREPARATION: B-12, B-20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

LABORATORY. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater im-

portance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks; gauges, inductors and counters; barrel, separating and throttling carolimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

HEAT ENGINEERING—B-33. Preparation: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the value gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

MILL ENGINEERING—B-34. Preparation: B-21, B-25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

MILL ENGINEERING—B-34a. Preparation: B-21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B-34. [Courses I, II.]

PRINCIPLES OF MARKETING—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

MARKETING METHODS—B-36. Preparation: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the

planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

STATISTICS—B-37. PREPARATIONS: B-20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

ACCOUNTING—B-40. PREPARATION: B-10 AND E-30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing business. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

TEXTILE MICROSCOPY—B-41. PREPARATION: B-23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Courses III, VI.]

TEXTILE MARKETING—B-42. PREPARATION: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses III, IV and VI, Options G, C, W, D.]

TEXTILE TESTING—B-43. PREPARATION: B-23, F-30 OR G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. One two-hour period per week of testing laboratory work is included in the course. Course VI.]

TEXTILE TESTING—B-43a. PREPARATION: B-23, F-20 OR G-20, D-20 OR D-21. This subject is presented in thirty lecture periods during the third year of the diploma courses. It is similar in content to B-43 but less extensive. [Course I, II, III.]

TEXTILE TESTING—B-43b. PREPARATION: B-23, F-20 OR G-20, D-20 OR D-21. A continuation of Textile Testing B-43 into a second term and composed of an additional fifteen hours of laboratory of physical textile testing and thirty hours of chemical testing. [Course VI, Options G, C, W, D.]

ELECTRICAL ENGINEERING—B-44. PREPARATION: B-31. During the first term polyphase circuits and alternating current machinery are studied. This includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for this motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all of the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises.

The second term work covers the study of industrial applications of electricity as applied to the textile industry, and includes the distribution of power, types of motors and drives, lighting of plant, use of electricity for heating, and electronic devices used in the textile industry. The work is covered by lecture and laboratory exercises and several trips are made to local mills to see the equipment in actual operation. [Course VI, Options G, C, W.]

MILL ENGINEERING—B-45. PREPARATION: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

BUSINESS ADMINISTRATION—B-46. PREPARATION: B-10 AND E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

BUSINESS LAW. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

MILL ILLUMINATION—B-47. PREPARATION: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

ELECTIVES—B-48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

PRINCIPLES OF SELLING AND ADVERTISING—B-49. PREPARATION: B-36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

FOREIGN TRADE AND ECONOMIC GEOGRAPHY—B-50. PREPARATION: E-30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

SELLING POLICIES—B-51. PREPARATION: B-36. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

CHEMISTRY AND DYEING—C

ELEMENTARY INORGANIC CHEMISTRY—C-10. PREPARATION: ADMISSION REQUIREMENTS. During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C-12. [All courses.]

ELEMENTARY ORGANIC CHEMISTRY—C-11. PREPARATION: ADMISSION REQUIREMENTS. This course, covered by lectures during the second term, includes a general survey of the fundamental principles of Organic Chemistry, also a study

of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C-21. [All courses.]

QUALITATIVE ANALYSIS—C-12. Preparation: C-10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C-10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as mordanted cloths, pigments and the various dyeing reagents.

Semi-Micro Qualitative Analysis.—Qualitative analysis for the more common elements by micro methods, with centrifuge, spot tests, etc. [Course IV.]

QUALITATIVE ANALYSIS—C-12a. Preparation: C-10, taken simultaneously. This course is similar to C-12, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

STOICHIOMETRY—C-13. Preparation: C-10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

CHEMICAL TECHNOLOGY OF FIBERS—C-20. Preparation: C-10, C-11. This course consists of a series of lectures on the origin, composition and processing of the natural fibers; also the manufacture and properties of the artificial fibers. The chemical and physical properties of the fibers which influence their suitability for textile uses are emphasized. The following outline suggests the scope of the course:

Classification of fibers by origin, by importance, and by chemical composition; properties necessary in a successful textile fiber; chemistry of cellulose, cotton, flax, ramie, jute, hemp, kapok; chemistry of proteins, silk, tussah, wool, reclaimed wool, mohair, other hairs; asbestos; manufactured fibers—history, production of filament and staple fiber, methods of delustering, manufacture of high tenacity yarns, details of manufacture of acetate, cupra, viscose, casein, vinyl, and nylon fibers, comparison of the manufactured fibers with each other and with comparable natural fibers. (All courses.)

TEXTILE CHEMISTRY AND DYEING—C-21. Preparation: C-10, C-11, B-12, B-13a. The outline of the lecture course which is given during the second year is as follows:—

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Coal-Tar Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

DYEING LABORATORY—C-22. Preparation: C-21 taken simultaneously. In addition to the lectures in Textile Chemistry and Dyeing practical laboratory work is required. The action of chemical reagents on the various natural and

manufactured textile fibers is studied, as well as the preparation of these fibers for dyeing. Some time is also spent in studying the bleaching processes on all fibers. A systematic study of the application of the different classes of dyes to cotton, wool, silk, various rayons and union materials, is carried out. Each student is required to keep a notebook containing samples of treated or dyed material and all data regarding the processes used.

Work in color matching is also carried out on a laboratory scale. A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

ORGANIC CHEMISTRY—C-23. Preparation: C-11. The purpose of this course is to lay a broad foundation for the understanding of the basic principles of organic chemistry. The first semester consists of illustrated lectures and recitations covering the aliphatic series. The second term is devoted to the aromatic compounds. A number of problems are assigned as home exercises in order to fix the fundamental principles of the science in the student's mind. Books: Wertheim—Organic Chemistry and E. H. Huntress—Problems in Organic Chemistry. [Course IV.]

QUANTITATIVE ANALYSIS—C-24. Preparation: C-12. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1937 Edition is used as a text. [Course IV.]

QUANTITATIVE ANALYSIS—C-24a. Preparation: C-12. The object of this course is to prepare the student for Course C-43 (Chemical Textile Testing). Instruction is given in the use of the analytical balance, in the determination of moisture and ash in fabrics, and in the titration of acids and bases. [Course V.]

STOICHIOMETRY—C-25. Preparation: B-10, C-10, C-13. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

FIBRE STUDY—C-26. Preparation: C-10, C-11, B-12, B-13. A study of the physical and chemical properties of the artificial fibers in comparison with the natural fibers which they sometimes replace and with which they are frequently used. The advantages and disadvantages of each fiber for particular uses are discussed. [Course V.]

QUANTITATIVE ANALYSIS—C-30. PREPARATION: C-24. The fundamental principles acquired in Course C-24 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. "Commercial Methods of Analysis" by Snell and Biffin is used as a text. [Course IV.]

INDUSTRIAL CHEMISTRY—INORGANIC—LECTURE—C-31. PREPARATION: C-23. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Shreve's "Chemical Process Industries." Particular attention is paid to the purification of industrial water supplies, the manufacture of heavy chemicals, such as acids, alkalies, bleach liquors and mordants and the building industry, including the manufacture of Portland cement, glass, iron and steel. The course is illustrated as far as possible with specimens, diagrams, and charts. [Course IV.]

ADVANCED TEXTILE CHEMISTRY AND DYEING—C-32. PREPARATION: C-21, C-22. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

COLOR MATCHING AND COLOR COMBINING.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

DYE TESTING.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

UNION DYEING.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

TEXTILE PRINTING.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Dye House and Finishing Plant Management.—A study of the organization and management of the modern bleacheries, dyehouses and finishing plants.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

PHYSICAL CHEMISTRY—C-33. Preparation: B-10, C-10, C-13. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C-42 in the fourth year. [Course IV.]

ORGANIC CHEMISTRY—C-34. Preparation: C-23. This course (one semester) is a continuation of Organic Chemistry C-23 extending over the alicyclic and heterocyclic series. The lectures also touch upon certain special topics such as general synthetical methods, theoretical considerations, natural products (vitamins, hormones, chlorophyl, the blood pigments, alkaloids), dyestuffs, etc. Book: Panagiotakos—Organic Chemistry. [Course IV.]

TECHNICAL GERMAN—C-35. Preparation: C-21, C-23, E-21. This course consists of the reading of German technical literature with the object of familiarizing the student with the German and scientific publications in textile chemistry and coloring. [Course IV.]

ORGANIC CHEMISTRY LABORATORY—C-36. Preparation: C-21, C-23, C-24. A number of typical organic compounds are synthesized by general methods. A special problem is also assigned to train the student in longer or more difficult synthesis (one semester). Laboratory Book: Gatterman-Wieland—Laboratory Methods of Organic Chemistry. [Course IV.]

ORGANIC CHEMISTRY LABORATORY—C-41. Preparation: C-21, C-23, C-24. A number of typical organic compounds are synthesized by general methods. A special problem is also assigned to train the student in longer or more difficult syntheses. Laboratory Book: Gatterman-Wieland—Laboratory Methods of Organic Chemistry. The second semester is devoted to the qualitative identification of organic compounds. Laboratory book: Mulliken-Huntress—Identification of Organic Compounds. [Course IV.]

INDUSTRIAL CHEMISTRY—ORGANIC—C-42. Preparation: C-31. The chemistry and technology of the important organic industries, *i.e.*, rubber, petroleum, dyestuffs, drugs, explosives, oils, fats, soaps, waxes, plastics, fermentation products, etc., is considered, with special emphasis on rubber, petroleum and explosives in view of present war conditions. Synthetic methods and the research and development phases are stressed. [Course IV.]

CHEMICAL TEXTILE TESTING—C-43. Preparation: C-22, C-32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing.— Inorganic extraneous matter: ash, ash alkalinity, silk weighting, acids and alkalies. Organic extraneous matter: scouring loss, extraction, sizing and finishing materials. Fiber mixtures: qualitative analysis, quantitative analysis. Swelling and damage in cellulose fibers: qualitative tests, barium activity number, ash alkalinity, solubility in sodium hydroxide, Methylene Blue absorption, copper number, fluidity. Damage to wool: lead acetate test, thiocyanate test, Pauly test, methylene blue test, sulfur content, total nitrogen content, soluble nitrogen, ammonia nitrogen, solubility in dilute alkali. Damage to silk: Zimmermann test, total nitrogen, ammonia nitrogen, viscosity in zinc chloride.

Optical Testing.—Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

ADVANCED TEXTILE CHEMISTRY AND DYEING—C-44. Preparation: C-32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

MICROSCOPY AND PHOTOMICROSCOPY—C-45. Preparation: B-23, C-21, C-23. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon. [Course IV.]

QUANTITATIVE ANALYSIS—C-46. Preparation: C-30. This course consists of lectures, recitations and quizzes on stripping agents and fuels. [Course IV.]

REPORT WRITING—C-47. Preparation: B-20a, E-20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

TEXTILE LITERATURE—C-48. Preparation: C-47. The object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

ADVANCED GENERAL CHEMISTRY—C-49. Preparation: C-10, C-12, C-25, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

COLLOID CHEMISTRY C-50. Preparation: C-33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Adsorption, surface tension and wetting-out, viscosity, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of the "irreversible emulsoids," protective colloids, mechanism of detergency and study of commercial detergents, gels and the Donnan Membrance Equilibrium, use of X-rays, properties of proteins, iso-electric point, plastics and plasticity.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, cellulose esters and ethers, rayons, starch, pectins and gums, silk, silk weighting, wool, wool scouring, crabbing, fulling wool shrinkage, casein wool, nylon, synthetic resins of all types, but particularly those used in textile finishing, theories of dyeing and printing. [Course IV.]

THE CHEMISTRY OF RAYON, ITS MANUFACTURE, BLEACHING, DYEING AND FINISHING—C-51. Preparation: C-32. The students are required to prepare papers on the manufacture and subsequent treatment of rayon and other synthetic fibers. The students present these papers before the class and a question period follows in which the instructor and members of the class bring out important points not covered by the paper.

Lectures and a visit to a rayon plant complete the course. [Course IV.]

FIBER PRODUCTION—C-52. Preparation: C-20, C-23, H-32. A study of the methods of manufacture of the artificial and synthetic fibers, also the methods of delustering, and preparation of the fibers for the textile market. Consideration is also given to the more important synthetic finishing agents which are used in connection with the artificial fibers for increased crease resistance, improved shrinkage properties, and modified dyeing ability of the fibers. [Course V.]

CHEMICAL ENGINEERING—C-53. Preparation: B-20a, C-31, C-42. This course covers descriptive and quantitative information on the following branches of chemical engineering: flow of fluids, flow of heat, hygrometry, humidification and dehumidification, drying, textile drying, materials of construction, and any of the other unit processes for which there is time. The course consists of lectures supplemented by the working of numerous practical problems. [Course IV.]

ELECTIVE SUBJECTS OR THESIS DURING FOURTH YEAR—C-54. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind several electives have been introduced, each elective period being 45 hours per term and four of these being required during the year.

THESIS. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

PHOTOGRAPHY. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

PHOTOMICROSCOPY LABORATORY. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this elective should have had Photography or the equivalent in experience.

ADVANCED MICROSCOPY. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

COLLOID CHEMISTRY LABORATORY. Experiments illustrating and amplifying the lecture course are performed. These may be on adsorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

TEXTILE CHEMISTRY LABORATORY. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

MICROBIOLOGY I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

MICROBIOLOGY II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

RAYON. Advanced study of rayon dyeing.

PHYSICAL CHEMISTRY. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conductivity, etc.

ADVANCED PREPARATIVE CHEMISTRY. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE—CHEMICAL ENGINEERING. Preparation: B-11, B-12, B-13, B-23, C-21, C-25, C-42. A combination of lectures and laboratory work designed for the study of the thermal properties of fluids, laws of thermo-dynamics as applied to batch and flow processes, flow of heat, mechanical mixtures, and heat engines.

This course will include such practical applications to the dyeing, printing, and finishing branches of the textile industry as efficient use of steam in heating dye kettles—steam traps—measuring of steam used—calculating steam costs—study of best methods of piping steam for manufacturing purposes and economics of hot water storage.

Compression and fluid handling, testing of pumps, fans and similar chemical engineering equipment including some calibration of instruments will serve to give the student a general over-view of elementary chemical engineering.

GLASS BLOWING. A course in the elements of laboratory glass blowing, designed to give the man going into laboratory work a familiarity with the methods of handling both soda glass and Pyrex. All the ordinary seals and joints used in construction of apparatus are described and tried out in the laboratory.

LEATHER CHEMISTRY. This course deals with the chemistry and technology of leather manufacture as well as with the fundamental chemistry of proteins and enzymatic action. It includes the consideration of high molecular weight compounds, the chemistry of fats and proteins, the action of the leather industry including tanning operations, and various applications of analytical chemistry.

COLOR MATCHING. A further study of the principles involved in color matching accompanied by actual matching in the dyeing laboratory of many dyed samples of a variety of colors.

EXPLOSIVES AND CHEMICAL WARFARE. The history, chemistry, physiological action and military use of the war poisons and of explosives is taken up. The course also treats of the protective measures against chemicals and the tactical use of the weapons.

ADVANCED ORGANIC CHEMISTRY. This course deals with theoretical organic chemistry and the biochemical aspects of the science such as the isolation, proof of structure and synthesis of physiologically important compounds and the chemistry of synthetic compounds of biochemical interest.

TEXTILE DESIGN AND WEAVING—D

TEXTILE DESIGN AND CLOTH ANALYSIS D-10. Two terms. Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from the design, and vice versa; extending and extracting weaves. This subject also takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk, and yarns made from the great variety of vegetable and synthetic fibers; grading of yarns, folded, ply, novelty and fancy yarns; problems involving take-up, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses. Second term, Courses I, II, III, V, VI, Options C, W, G, D, S.]

HAND LOOM WEAVING D-11. Preparation: D-10. One term. This work precedes power weaving and consists of making original patterns and cloth construction. This subject correlates with the first year textile design work and aims to stimulate and inspire the student-designer to realize possible combinations of weave and color in a variety of yarns to produce fabrics for different purposes. [Course III.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION D-20. Preparation: D-10. Two terms. *For Cotton and synthetic fabrics.* In the first term consideration is given to fancy and reverse twills, damasks, skip weaves, sateen fabrics with plain ground. In the second term fabrics studied are those having extra warp and extra filling figured patterns. Both terms include the analysis of the fabrics as well as the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [First term, Courses I, III, V, VI, Options C, D, S. Second term, Courses I, III, VI, Options C, D, S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION D-21. Preparation: D-10. Two terms. *For Woolen, Worsted and Synthetic Fabrics.* In the first term instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second term instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas and extra warp and filling figures. [First term, Courses II, III, V, VI, Options W, D, S. Second term, Courses II, III, VI, Options W, D, S.]

TEXTILE DESIGN D-22. Preparation: D-10. One term. This is a short course covering the elementary principles of designing in general. The term work is divided into two parts. Instruction is given in the theory of shrinkages and the layout of basic woolen and worsted fabrics, followed by similar instruction in the design and construction of basic cotton fabrics. [Course VI, Option G.]

COLOR D-23. Two terms. This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks, plaids and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question. [Courses III, VI, Options D, S.]

COLOR D-23c. One term. This is a lecture course covering the same information as D-23 and applied entirely to cotton fabrics. [Course I.]

COLOR D-23w. One term. This is a lecture course covering the same information as D-23 and applied to woolen and worsted using hand cards and colored stock. [Course II.]

POWER WEAVING—D-24. PREPARATION: D-10. Lectures are given covering all methods of warp preparation and include cotton, synthetic, woolen, worsted, and mixed fiber yarns. The warp preparation also covers slashing as well as rayon and synthetic soaking. Practical work is carried out on the machinery in the laboratory. The second half of this course deals with weaving on the cam loom. The lectures include names of parts, motions, and terms. Laboratory work supplements the lecture work by a series of achievements. [Courses I, II, III, VI, all options.]

POWER WEAVING D–25. PREPARATION: D-10. This is a lecture course and covers briefly the fundamentals of weaving, types of looms suitable for weaving different fabrics, warp preparation, especially slashing machinery and compounds for synthetic, cotton, woolen and worsted yarns and includes blends. [Courses IV, V.]

PERSPECTIVE D-26. One term. This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects having three dimensions showing correct proportions as they appear to the eye. This prepares the student for freehand drawing. [Courses III, VI, Option D.]

DRAWING D-27. PREPARATION:D-26. Two terms. This subject consists of freehand practice, by means of progressive steps, in training the eye to see accurately and to develop coordination of the hand to be able to depict a desired effect. It includes quick sketching and finished drawings of objects and nature to build a drawing vocabulary which will be an aid to decorative expression. [Course III.]

FIBER AND YARN IDENTIFICATION D-28. One term. This subject acquaints the student with fiber content, twist and defects of yarns through the use of the microscope. A brief account of how yarn is made is given by means of departmental guest speakers who are experts in cotton, wool, worsted and synthetics. [Course III.]

PRINCIPLES OF DESIGN D-29. One term. Through the principles of decorative design an understanding is acquired for the proper balance, distribution and repetition of motifs suitable for both the woven and the printed pattern. Historic designs of different periods and peoples are thoroughly covered to supply the student with a rich background of decorative information. This source of inspiration is coupled with modern thought and application, as an aid to producing appropriate present day decorative textiles. [Courses III, VI, Options D, S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION D-30. PREPARATION: D-20. Two terms. *For Cotton and Synthetic Fabrics.* This work takes up the more complicated weaves adapted to harness work, and includes the following fabrics: Extra warp and extra filling checks and clipped spots, together with original layouts as might be required by a mill to produce a new pattern; Bedford Cords, Piques, Velveteens, Corduroys, Collar fabrics, multi-ply fabrics and narrow webbing. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs, both modified and original, the calculations involved in the reproduction of standard fabrics

changed to meet varying conditions of weight, stock, counts of yarn and value. Instruction in this subject is intended to bring together the principles considered under the subject of design, cloth construction, weaving, and yarn making of previous years and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION D-31. PREPARATION D-21. Two terms. *For Woolen, Worsted and Synthetic Fabrics.* This includes cost estimates for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs; the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, counts of yarn and value. Particular attention is given the construction of new designs by the use of suggestion sheets; the new fabrics to be constructed upon a base fabric, previously analyzed, along the lines outlined on the suggestion sheets, and to keep within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. [Courses III, VI, Options D, S.]

POWER WEAVING D-32. PREPARATION: D-20, D-21. Two terms. This is lecture work on woolen and worsted warp preparation with practical work in the laboratory. Subjects taken up in weaving are Knowles headmotion, woolen and worsted looms including automatics, dobby and Jacquard looms, card cutting and lacing, and pile fabrics and lenos. [Courses I, II, III, V, VI, Options D, S.; Courses VI C, W, G, one term.]

POWER WEAVING D-32. PREPARATION: D-24. Lectures and laboratory instruction cover dobby weaving and include single and double index, single and double cylinder, chains, timing, and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics, silk and narrow webbing. This course also covers pile cloth weaving, carpet weaving and leno weaving. [Courses I, II, III, VI, all options.]

JACQUARD DESIGN AND WEAVING D–34. PREPARATION: D-10, 20, 29. Two terms. Instruction includes the sketching of original designs as applied to particular fabrics. This subject correlates with the instruction in weaving of the Jacquard loom and the various tie-ups in common use. The student is taught to transfer his original sketch to cross section design paper, choose the proper weave for both the background and the foreground, cut cards and lace, and weave the fabric. [Courses III, VI, Options D, S.]

TEXTILE STYLING D-35. PREPARATION: D-20, D-21. One term. This subject includes fabric names, their distinguishing characteristics, purpose and suitability. A study of the costume with regard to fashion changes and recurrences as well as influences that in the past have changed costume, as an aid to better forecast of fabrics. [Courses III, VI, Options D, S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION D-40. PREPARATION: D-30. Two terms. *For Cotton and Synthetic Fabrics.* In this course consideration is given to the more complicated fabrics including elastic fabrics, both narrow and wide woven, Marseilles Quilting and Toilet Cloths, plain gauze fabrics, and Fancy Leno-woven cloths using the modern steel doup and super-doup. [Courses III, VI, Options D, S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION D-41. Preparation: D-31. Two terms. *For Woolen, Worsted and Synthetic Fabrics.* This includes analysis and reproduction of ply fabrics and combinations of work as outlined on suggestion sheets in D-31. Laboratory instruction is given in the identification of various textiles fibers. In connection with this work samples are analyzed for quality and quantity of fibers present. [Courses III, VI, Options D, S.]

LANGUAGE AND HISTORY—E

ENGLISH—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

ELEMENTARY GERMAN—E-11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

ENGLISH—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

ADVANCED GERMAN—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

ECONOMICS—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

SEMINAR IN BUSINESS ENGLISH—E-40. PREPARATION: E-10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON YARNS AND KNITTING—F

COTTON CARDING—F-20. PREPARATION: B-10, B-12, B-13. This course is given in the first term of the second year and includes instruction regarding the growth, classing and handling of raw cotton and the processes of opening, picking and carding. Considerable time is spent studying cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. The basis of cotton classing is thoroughly covered here and the general background of how cotton is bought and sold is explained.

The mill processes of opening, picking and carding, and the many different types of machines in use are thoroughly studied. Special textbooks with many illustrations have been prepared so that the student may devote his entire attention to class discussions. The calculations pertaining to the various operations are covered in detail. The various settings possible and their effect on quality or production are made clear also.

The laboratory work for this course includes classing practice, fiber study and comparison, waste tests and comparisons, and studies of machine constructions and gearings. [Course I.]

COTTON CARDING—F-20a-b-c. PREPARATION: B-10, B-12, B-13. These courses include the same lectures as course F-20 but the time devoted to laboratory work is reduced progressively in the order given. [F-20a Course VI, Option C; F-20b Course VI, Options G, S; F-20c Course VI, Option D.]

COTTON CARDING—F-21. PREPARATION: F-20. This course, given in the second term of the second year, is a continuation of the work of the first term and includes work on carding, combing, drawing and roving. Here again, special textbooks have been prepared with many illustrations, showing machine cross-sections and details of different actions and parts. While the main part of the work is to clearly explain the purposes and principles of each machine, all the various calculations and settings pertaining to each are carefully studied and problems are assigned for student practice.

The laboratory work required in connection with this course includes a series of specific experiments illustrating various phases of the work of each operation. Other laboratory work consists in processing various lots of cotton in preparation for spinning. [Course I.]

COTTON CARDING. F-21a-b-c. PREPARATION: F-20a-b-c RESPECTIVELY. These courses include the same lectures as Course F-21 but the time devoted to laboratory work is reduced progressively in the order given. [F-21a Course VI, Option C; F-21b Course VI, Option G; F-21c Course VI, Options D. S.]

COTTONS F-22. Preparation: F-20 taken Simultaneously. This course consists of lectures and laboratory work, supplementary to Course F-20, for those students who study cotton only. Some time is spent on the details of cotton fiber growth and structure and in comparing cotton with other fibers. The economic importance of cotton is studied and sources of information regarding cotton and its processing are given to the class. [Courses I, VI, Option C.]

COTTON WASTE PROCESSING—F-23. Preparation: F-20, F-21. For those specializing in Cotton Manufacture, this course provides a survey of the methods and machinery used in processing cotton wastes, or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment and the manufacturing processes. Samples of wastes and products are used to demonstrate the possibilities in this field.

The laboratory work of Courses F-20 and F-21 provide practice with some wastes and their processing. [Courses I, VI, Option C.]

SYNTHETIC YARN, COTTON SYSTEM—F-24. Preparation: B-10, B-12, B-13. This course, which continues through the entire second year, provides instruction regarding standard machinery used in cotton manufacturing. As much staple fiber is spun on this type of equipment, the work of the course parallels that normally given to students in Cotton Manufacturing. Instruction covers opening, picking, carding, combing, drawing and roving machinery, its construction, principles of operation and the calculations regarding each of the operations.

A limited amount of time is devoted to laboratory practice to demonstrate the machinery being studied, showing actual commercial machines producing material to be used in later operations. [Course V.]

COTTON SPINNING—F-30. Preparation: F-21. This course is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning. Such details as spindles, rings, travelers and builders are carefully explained and such factors as twist, contraction and strength of yarns are thoroughly studied. Particular consideration is given to the production of yarns for different uses and how desired characteristics may be obtained. All the calculations regarding yarns and spinning frames are thoroughly studied and problems are assigned for student practice.

The laboratory work for this course includes a series of specific experiments and tests illustrating important phases of the operations and practice in spinning various counts from roving which the students have made previously. [Course I.]

COTTON SPINNING—F-30a-b. Preparation: F-21a and F-21b-c respectively. These courses include the same lectures as Course F-30 but the time devoted to laboratory practice is shortened in different degrees. [F-30a Course VI, Option C; F-30b Course VI, Option G, D, S.]

COTTON WINDING AND TWISTING—F-31. Preparation: F-30. This course is a continuation of the course on spinning, in which the instruction includes the conclusion of spinning, spooling and the various types of winding, twisting of common and fancy yarns and such incidental features as reeling, baling, mule spinning and rope manufacture. (Some of these items are optional.) All the calculations regarding winders and twisters are thoroughly studied and problems are assigned for student practice.

The laboratory work includes specific studies, experiments and yarn analyses. Other work required involves the winding of yarns under various conditions and the production of plied yarns to meet specified construction. [Course I.]

COTTON WINDING AND TWISTING—F-31a-b. Preparation: F-30a-b respectively. These courses include the same lectures as Course F-31 but the time devoted to laboratory practice is shortened in different degrees. [F-31a Course VI, Option C; F-31b Course VI, Option G, D, S.]

COTTON QUALITY CONTROL—F-32. PREPARATION: F-21, F-30, OR F-21a, F-30a. While it is customary to point out defects in the materials during the processing in all the laboratory work, this course provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this course. Every effort is made to develop the student's diagnostic ability so that he may readily recognize and remedy new defects as he meets them. [Courses I, VI, Option C.]

STAPLE FIBER MANUFACTURE—F-33. PREPARATION: F-21, F-30, OR F-21a, F-30a. Using the preparatory courses as a background, this course offers a study of the methods of manufacture of various staple fibers, such as wool, rayon or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the course is planned to take advantage of the new developments as they appear. Considerable of the work in this course is of the discussion type, which aims to correlate all the work on yarn manufacture and bring it to bear on the processing of staple fibers. [Courses I, VI, Option C.]

MILL ORGANIZATION—F-34. PREPARATION: F-21, F-31a OR b. This course correlates all the work on Cotton Manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and the handling of staple fibers are carefully covered. The machinery necessary to keep plants in balance is calculated, with some consideration of the best arrangements for economical handling. Some time is given to the use of efficiency work and end breakage studies for cotton mills. [Courses I, V, VI, Options G and C.]

SYNTHETIC YARN, COTTON SYSTEM—F-35. PREPARATION: F-24. Running through both terms of the third year, this course continues the work of staple fiber manufacture on the Cotton System. The major topics are ring spinning, winding and ring twisting. The subject matter of the lectures covers the construction and principles of regular and long draft spinning equipment, various types of winders and plain and fancy twisters. The calculations for the operations are included, along with analysis and reproduction of various yarns.

A limited amount of time is devoted to laboratory exercises demonstrating these operations and producing various single and ply yarns. [Course V.]

THESIS—F-36. PREPARATION: F-21, F-30. Each student is required to present a thesis which is a report of some original work. In some cases this is the production of some yarn or fabric to meet certain requirements. In other cases, the thesis is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

COTTON LABORATORY—F-40. PREPARATION: F-30a OR b AND F-31a OR b. Because of the limited amount of laboratory time available in the second and third years of engineering courses, this time is provided to give additional laboratory practice which will give the student a more thorough acquaintance with cotton manufacturing equipment and its use. Experimental work may be carried on for any operation depending upon how thoroughly previous laboratory work has covered the subject. [Course VI, Options G, C.]

KNITTING—FK-21. PREPARATION: B-12, D-10. This partial course, which is given in the second term of the second year for certain options of the engineering course, covers the first half of the lectures and laboratory work given in Course FK-30. [Course VI, Options, D, G.]

KNITTING—FK-30. PREPARATION: B-12, D-10. This course is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

The laboratory work consists of a series of carefully organized experiments in which the students operate standard machines to produce some knitted article or fabric. Auxiliary equipment for transferring, looping and sewing is available if needed. Fabric and hosiery analysis are included in this work. [Courses I, II, V, VI, Options G, C, W.]

KNITTING—FK-30a. PREPARATION: B-12, D-10. This course embraces the same lectures as Course FK-30 but does not include any laboratory work. [Courses III, VI, Option G.]

KNITTING—FK-30b. PREPARATION: B-12, D-10. This course embraces the same lectures as Course FK-30 but has only one-half the laboratory time. [Course VI, Option S.]

KNITTING—FK-31. PREPARATION: FK-21. Given in the first term of the third year, this is a continuation of Course FK-21 and completes the work given as lectures and laboratory in Course FK-30. [Course VI, Options D, G.]

KNITTING—FK-40. PREPARATION: FK-31. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL—G

FIBER PREPARATION—G-20. PREPARATION: B-10, B-12, B-13, C-10. RAW MATERIALS.—A study of fibrous materials which can be spun into manipulated type yarns by the woolen or worsted system of manufacture, includes animal, vegetable and synthetic fibers.

WOOL CLASSIFICATION.—Breeds of sheep, wool grading and sorting, are covered in lecture and laboratory with emphasis on blood and count classification of fiber and methods of shrinkage determination.

WOOL SCOURING.—The cleansing of grease wool by the emulsion and solvent methods is covered from opening to drying, with emphasis on temperatures, soaps, chemicals, and reclamation of by-products.

CARBONIZING AND BUR PICKING.—Various methods of removing vegetable matter from wool are explained and practiced.

REWORKED FIBERS.—Hard and soft mill wastes are explained and observed as well as rag sorting with all processes used in converting rags to fiber. [Courses II, VI, Options G, W, D, S.]

TOP MAKING—-G21. PREPARATION: B-10, B-12, B-13. WORSTED CARDING.—Lectures and laboratory work cover all details of the worsted card necessary to produce well opened sliver of wool or synthetic fibers.

BACK WASHING.—The back washing of carded sliver is fully covered.

Gilling.—The principle of gilling is explained and observed on both open and intersecting machines.

Combing.—The operation of both Noble and French combs is covered in lectures and laboratory work with emphasis on comparative adjustments for natural and synthetic fibers.

Blending.—The calculations and methods used in making blends of colors or mixtures of fibers are explained and practiced. The cutting of synthetic tow into uncombed top is explained.

Top.—Top analysis, stapling and classification is explained as well as marketing methods. [Courses II, VI, Options G, W, D, S.]

SYNTHETIC YARNS, WOOL SYSTEM—G-22. Preparation: B-10, B-12, B-13. Details of special operations necessary to produce woolen type yarns from synthetic fibers are fully covered. [Course V.]

WOOLEN YARNS—G-30. Preparation: G-20. Fiber Blending, Oiling and Picking.—Various methods of blending and opening of fiber mixes are covered in lecture and laboratory. The importance of oils and emulsions is discussed in detail.

Woolen Carding.—The basic principles of carding are explained and observed. The construction, operation and maintenance of both ring and tape condenser cards is covered in detail.

Woolen Spinning.—The principle of drawing and spinning fibrous materials into yarn is covered thoroughly in lectures and laboratory with emphasis on the details of the construction, maintenance, and operation of the woolen mule and spinning frame.

Twisting.—Yarn conditioning is discussed as well as methods of producing fancy twists and novelty yarns for knitting or weaving. [Courses II, VI, Options G, W, D, S.]

WORSTED YARNS—G-31. Preparation: G-21. Top Analysis.—Top stapling and analysis necessary for correct adjustment of drawing and spinning machinery is observed and discussed.

Worsted Drawing.—Methods, calculations and adjustments of machinery necessary to draw top ready for spinning on both French and English systems are explained and practiced.

Spinning and Twisting.—Various methods of spinning are thoroughly explained and practiced with some emphasis on twisting for knitting or weaving yarns.

Organization.—Mill layouts are discussed with regard to efficiency and balance. (Courses II, VI, Options G, W, D, S.)

SYNTHETIC YARNS, WOOL SYSTEM—G-32. Preparation: G-22. Details of special operations necessary to produce worsted type yarns from synthetic fibers are fully covered. (Course V.)

Thesis. Before graduation from Course II a student must make a short cut of woolen or worsted fabric and submit an acceptable record of all details involved.

TECHNOLOGY OF WOOL MANUFACTURE—LECTURES AND DEMONSTRATIONS—G-40. Preparation: C-21, C-32, D-10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING—H

WOOLEN AND WORSTED FINISHING—H-30. Preparation: B-12, C-10, D-10, D-24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing processes, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oils, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, V, VI, Options G, W, D, S.] [Course V omits Carbonizing, Gigging and Napping.]

COTTON FINISHING—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses, — steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

FABRIC FINISHING—H-32. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of synthetic fabrics is as follows:

Cloth Room.—Instruction in the handling of the various fabrics.

Singeing.—The object of singeing; the construction of the various types of singers; the object of the different methods of cooling.

Washing. — Open width, string and slack rope, and the object thereof.

Quetch and Mangles.—The object and construction.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, net dryer, tenter frames, clips, button breakers, etc.

Silk Calenders.—The object and construction, including the regulation of pressures.

Decator.—The reason for and the methods used.

Make-up Room.—Yarding, inspecting, winding, pressing and papering. [Course V.]

EQUIPMENT

The equipment of machinery, inventoried at $500,000.00, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

COTTON YARN DEPARTMENT.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a special section with north light, where Universal Standard

Grades, Government Staple Standards, and many different commercial cottons, American and foreign, are available.

The opening and picking equipment consists of one Saco-Lowell Vertical Opener and a 40-inch Saco-Lowell Three Beater Single Process Picker with a Blending Reserve.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper. one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

For drawing, there is a two delivery Howard and Bullough head equipped with metallic rolls and electric stop motion. From the Saco-Lowell Shops, there is a railway head and two four delivery heads, one of which is equipped with a Chapman Neutralizer.

The roving section has a Woonsocket 8 x 4 frame with Whitin Superdraft equipment, a full line of regular roving machines—Slubber Intermediate, Fine and Jack from the Saco-Lowell Shops and a Fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. Two are equipped with the latest Saco-Lowell Roth Long-Draft System. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman Ball-Bearing Spindles. The Whitin Machine Works is represented by five frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF Roller-Bearing Spindles and is fitted on one side with Casablanca Long-Draft equipment. Two of these frames are the Fales and Jenks type, one of which has 36 spindles with one side equipped with Casablanca Long Draft system. The other is a 72 spindle frame equipped with the latest Whitin Long Draft system. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. An Asa Lees Company mule, suitable for counts above 30's, has been retained to illustrate this peculiar type of spinning.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end 20-inch derby doubler; a 40-inch four coiler finisher card and a combination slubber-intermediate. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for

determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. A seriplane yarn winding device and a Saco-Lowell Sliver Tester are used for examining variability of yarns and slivers. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser. Other equipment for use in fiber study consists of a Baer Sorter, a hand microtome and projecting apparatus for drawing fiber detail.

KNITTING SECTION.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns, and a Foster winder suitable to wind cones or tubes.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; two Dubied scarf machines, and a Raschel warp knitter.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines and a Mayo model C full automatic. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3–5¼ and arranged for needles varying in number from 100–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of a Scott & Williams ribber, a Wildman ribber, a single head Crane spring needle machine and a two head Tompkins spring needle machine. Melting pots and molds are available for leading needles.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 20-point looper with an individual table and motor drive and a variety of sewing machines suitable for welting, seaming, and finishing underwear and outerwear.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

WOOL YARN DEPARTMENT.—The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60 x 40 three cylinder set of cards with Garnet Breast, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48 x 40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company; one 20 spindle 2½-inch ring twister for novelty yarns.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders and one roll grinder complete.

REWORKED FIBER DIVISION.—Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are many samples of reworked wool in all stages from rags to fiber.

WOOL PREPARING DIVISION.—Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Many samples of all types of wool are available for study.

TOP MAKING DIVISION.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells; one Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device.

WORSTED YARN DIVISION.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory as well as in the testing laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

FRENCH SYSTEM.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Société Alsacienne de Constructions Mechaniques, and the equipment consists of the following: third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

TESTING EQUIPMENT.—For routine mill and research testing a conditioning room is provided which is humidified by G. M. Parks Company equipment.

Testing machines include the following: Henry L. Scott & Company skein and fabric tester; one Emerson conditioning oven with Toledo scales; one Bausch & Lomb projecting microscope for fiber analysis; one Alfred Suter top stapling machine with scales; one top inspection stand with duplex mercury lamp lighting; one Edgerton stroboscope; five copper bowls for scouring by hand; complete set of U. S. wool standards for fiber comparison.

DESIGN AND POWER WEAVING DEPARTMENT.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation room, the cotton section includes a Universal cone winder, an Entwistle warper and a Saco Lowell slasher. The woolen and worsted section includes two jack spoolers, one wet and one dry dressing frame, an 82-inch reel, and 94-inch reel, and one double head beamer all supplied by the Davis & Furber Machine Co. The silk and rayon section includes a winder, narrow warper and beamer.

The filling winding section contains a Universal No. 90 winder and a Davis & Furber 40-end jack winder.

The weave room contains a total of 57 looms. The cotton section of 40 looms includes one wide sheeting loom, one wide blanket loom, one wide table cloth loom, 24 narrow looms for sheeting, towels, shirting, etc., and 13 Jacquard looms for towels, napkins, dress goods, carpets, overdrapes, etc. The woolen and worsted section of 12 looms includes 3 wide looms and 9 narrow looms for suitings, coatings, and blankets. The silk and rayon section of 5 looms includes 2 broad looms, one narrow loom and 2 Jacquard looms for shirtings, dress goods, overdrapes, etc.

CHEMISTRY AND DYEING DEPARTMENT.—The General Chemistry and Qualitative Analysis Laboratory provides facilities for 120 students.

The Quantative Analysis Laboratory contains two steam plates, drying closets, a gas hot plate, a Kjeldahl digestion unit and electro-analysis apparatus. Special apparatus used by the advanced quantitative class includes the following equipment: Abbe refractometer, Becker chainomatic Westphal balance, two Saybolt Universal viscosimeters, 1 Engler viscosimeter, Pensky-Martin flash tester, two Cleveland open cup testers, Conradson carbon residue apparatus, Titer test apparatus and Emerson oxygen bomb calorimeter. The balance room has 14 Christian Becker analytical balances and a Christian Becker calibration balance.

The Chemical Textile Testing Laboratory contains the following: Scott serigraph strength tester, Scott single strand strength tester, drying oven and analytical balance combination, twist counters, yarn reels, barometer, hygrometers, sling psychrometers, thickness gauge, duNuoy tensiometer, pick glasses, extraction

apparatus, heat transfer apparatus, waterproofness apparatus and the usual chemical apparatus and balances.

The Organic Laboratory has the necessary equipment required in the preparation of basic organic compounds, also instruments such as autoclaves, electric and gas combustion furnaces used in the manufacture of dyes.

The Microscopy and Optical Testing Laboratory contains a polarizing microscope, binocular microscope, twelve ordinary microscopes, rotary microtome, table microtome, Hardy sectioning device, comparison ocular, vertical illuminator, camero lucia, a large number of microscope lamps of various types, dark ground illuminators, polarizing equipment, dipping refractometer, Abbe refractometer, several spectroscopes, Duboscq colorimeter, Lovibond tintometer, ultra violet and infra-red radiation sources, optical pH apparatus and the necessary auxiliary equipment.

The Experimental Dyeing Laboratory is equipped with steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine; a yarn dyeing machine by Klauder-Weldon Dyeing Machine Company; a James Hunter sample dyeing machine; a jig dyeing machine; a chain dyeing machine; 3 fadeometers; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

FINISHING DEPARTMENT.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6–4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6–4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydroextractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing

and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 80-inch 24-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

ENGINEERING DEPARTMENT.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr, seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is the instrument laboratory and is for the purpose of giving instruction in the measurement of current, voltage, resistance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard Leeds & Northrup photometer with Lummer-Brodhun screen and Macbeth illuminometer provide means of illumination measurements.

MACHINE SHOP.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company; one 24 by 24 inch, 6-foot planer, from the

Mark Flather Planer Company; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son; one 14-inch single sensitive drill, from the Stanley Manufacturing Company; one No. 1 Universal grinder, from Landis Tool Company; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount; an American twist drill grinder, from the Heald Machine Company; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company; one 30-inch grindstone and frame, from the Athol Machine Company; a single spindle centering machine, from D. E. Whiton Machine Company; one 15-inch shaper, from Potter & Johnson; one power hacksaw, from the Fairbanks Company; one cold saw, from John T. Burr & Son; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

MICROSCOPY LAB GROUP

PRIZES AWARDED IN JUNE, 1945

THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS offers a medal to that member of the graduating class who maintains the highest standing throughout his course in Textile Engineering (General or Cotton Option) or the course in Cotton Manufacture. To *Warren Donald Moss.*

THE PROPRIETORS OF THE LOCKS AND CANALS ON THE MERRIMACK RIVER SCHOLARSHIP AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Several years ago the Proprietors of the Locks and Canals on the Merrimack River, a corporation owning the power rights on the Merrimack River in Lowell, gave to the Massachusetts Institute of Technology a sum of money to provide graduate scholarships to graduates from the Lowell Textile Institute who held a degree and were recommended by the trustees. Applicants must have maintained throughout their undergraduate courses a high scholastic record and must meet the requirements of the Graduate School of the Massachusetts Institute of Technology.

LOUIS A. OLNEY BOOK PRIZES.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

$10 to the student graduating from the Chemistry and Textile Coloring course, who, not having already received recognition by appointment as an assistant instructor, shall have maintained the highest scholarship through the course. To *José Varón Eskenazi.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Pauline Frances Riordan.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *John Joseph Bernard.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *James Michael Reynolds.*

STUDENT ACTIVITIES AND ORGANIZATIONS

SCHOOL PUBLICATIONS.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

SOCIETIES.—There are four fraternities, three of which are national and one local, also one sorority. They afford opportunity for social life desired in a college career.

DRAMATIC CLUB.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

PROFESSIONAL CLUBS.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Chapter of the American Association of Textile Chemists and Colorists sponsors meetings addressed by speakers on technical subjects.

RIFLE CLUB.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

HONOR SOCIETY.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

HONOR ROLL.—The President's List includes upper classmen taking a regular course who have a high scholastic rating and no deficiencies.

STUDENT BOOK STORE.—A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

GRADUATES OF 1945

Master of Science in Textile Chemistry
Roger Castle Griffin, Jr.
B.T.C., Lowell Textile Institute, 1943

Master of Science in Textile Engineering
Isaac Cohen
B.S., Robert College, 1942

Bachelor of Textile Chemistry

Alfred Thomas Grant
Sidney Milgrim
Joseph John Miranowicz
José Varón Eskenazi

Bachelor of Textile Engineering

Melvin David Goldberg
Theodore Michael Lint, Jr.
Charles Marinopoulos
*Warren Donald Moss
*Joseph Michael Schwartz

Candidates for Diplomas
In Wool Manufacture

Alvan Frederick Baggesen
Francis Jerome Bombara

*Tau Epsilon Sigma (Textile Scholastic Society)

REGISTER OF DAY STUDENTS

GRADUATE STUDENTS

Home Address	*Lowell Address*
BUSBY, JOHN CARROLL, JR., VI, Salisbury, N. C. S.B. Comm., University of North Carolina, 1940	73 Nesmith Street
DUNN, ROBERT, VI, Chungking, China B.S., Chinese National Southwest Associated University, 1941	137 Riverside Street
GAENSLY, HORST EWALDO, VI, Curitiba, Brazil C.E., Universidade do Parana, 1943	8 Mt. Washington Street
LYRA, MARIO SOUTO, VI, Rio de Janeiro, Brazil Industrial Chemist, Escola Nacional de Quimica, 1936	119 Sherman Street
TU, TZY-JIN, VI, Chungking, China B.T.E., Nantung University, 1936	222 Varnum Avenue

UNDERGRADUATE STUDENTS
CANDIDATES FOR DEGREES

CLASS OF 1946

BALAS, FRED FRANK, VI, Lowell, Mass.	104 Eleventh Street
CHAMBERS, EDWARD FRANCIS, VI, Chelmsford, Mass.	————
LANDRY, RITA PEARL, IV, Lowell, Mass.	348 Hildreth Street
LOREDO, JESUS DE BLAS, VI, San Luis Potosi, Mexico	186 Marlboro St., Boston
ROVNER, ALBERT HYMAN, VI, Chelsea, Mass.	————
SCARMEAS, HARRY GEORGE, IV, Lowell, Mass.	19 Mt. Vernon Street
TAMOSAUSKAS, ALBERT EDMUND, IV, Lowell, Mass.	574 Central Street

CLASS OF 1947

ALLARD, CLAUDE HENRY, IV, Lowell, Mass.	125 Nesmith Street
BAUER, JEROME FREDERICK, IV, Waterloo, Ont.	37 Varney Street
BECHARD, ROBERT WILLIAM, IV, Tyngsboro, Mass.	————
BERNARD, JOHN JOSEPH, IV, Lowell, Mass.	999 Moody Street
BLANCHARD, ARMAND EUGENE, VI, Southbridge, Mass.	32 Orchard Street
CHERENSON, ALAN HAROLD, VI, Lowell, Mass.	71 Canton Street
DEKALB, JOHN ERNEST, IV, Chelmsford, Mass.	————
FOLEY, ELEANOR ELIZABETH, IV, Lowell, Mass.	120 Fulton Street
GAULIN, BLANCHE ANNETTE, VI, Lowell, Mass.	429 Pawtucket Street
GORENSTIN, CARLOS, IV, Rio de Janeiro, Brazil	19 Dunbar Avenue
HAGGERTY, ISABEL FRANCIS, VI, Lowell, Mass.	127 Fort Hill Avenue
KLASHMAN, JULIAN BERNARD, VI, Cambridge, Mass.	————
LEVIN, MADELINE, IV, Lowell, Mass.	43 Ware Street
LEVY, LEONARD, VI, New York, N. Y.	19 Mt. Hope Street
LIMA, MANUEL FLORES, VI, Ciudad Mendoza, Mexico	8 Mt. Washington Street
MACINTYRE, ROBERT GARDINER, VI, Lowell, Mass.	32 Berkeley Avenue
MCMAHON, STILLMAN DILLON, IV, Lowell, Mass.	7 Belmont Street
DE MENDONCA, ALVARO OLYNTHO DA PRADO, IV, Rio de Janeiro, Brazil	21 Dunbar Avenue
MERRILL, JOHN WALCOTT, IV, Tewksbury, Mass.	————

Home Address	*Lowell Address*
MILLER, ALEX MICHAEL, VI, Perth Amboy, N. J.	392 Chelmsford Street
MORTON, JACKSON WENTWORTH, IV, Jamaica Plain, Mass.	———
NYSTROM, FREDERICK WALTER, VI, West Chelmsford, Mass.	———
POLITZER, KURT, IV, Rio de Janeiro, Brazil	19 Dunbar Avenue
PORTER, ROBERT ELLIS, VI, Ware, Mass.	19 Mt. Hope Street
QUEENEY, JOHN HART, VI, Scituate, Mass.	59 Porter Street
RIORDAN, PAULINE FRANCES, IV, Lowell, Mass.	21 Orchard Street
SARGENT, ANN EILEEN, IV, Lowell, Mass.	24 Maude Street
SASLOWSKY, SIDNEY, VI, Brooklyn, N. Y.	66 Lane Street
WILKINSON, MARY RUTH, IV, North Andover, Mass.	———
YANES, ARTHUR SELIG, VI, Brookline, Mass.	272 Merrimack Street

CLASS OF 1948

AMADO, LUCIANO SOLVEIRA, VI, Rio de Janeiro, Brazil	15 Douglas Road
BARDZIK, JOHN WALTER, IV, Dracut, Mass.	———
BIANCO, ALBERT LAWRENCE, IV, East Paterson, N. J.	21 Dunbar Avenue
BISKO, STEPHEN JOHN, VI, Dorchester, Mass.	252 Middlesex Street
FARREN, ROGER PATRICK, IV, Medford, Mass.	———
FIELD, LESLIE ADELBERT, JR., VI, Lowell, Mass.	230 Princeton Boulevard
GLADE, NATHANIEL HENRY, IV, Fall River, Mass.	5 White Street
GRIME, NORMAN BROWN, VI, Swansea, Mass.	Tewksbury, Mass.
HELLAND, HOWARD MANLEY, VI, Whitinsville, Mass.	11 White Street
HOYLE, ALBERT GERARD, IV, Lowell, Mass.	128 Mt. Hope Street
KAVOURAS, CHRISTOS NIKITAS, VI, Lowell, Mass.	5 Hancock Avenue
KING, JAMES ROBERT, VI, Lowell, Mass.	158 Howard Street
LANDRY, CHARLES JOSEPH, VI, Lowell, Mass.	348 Hildreth Street
LEITCH, JOHN BADGER, VI, Andover, Mass.	———
LEVIN, JORDAN, VI, Lowell, Mass.	141 East Merrimack Street
LIPPER, BERTHOLD, IV, Forest Hills, N. Y.	123 Riverside Street
McKITTRICK, VERNON RUSSELL, VI, Lowell, Mass.	19 Hawthorne Street
McKNIFF, JOHN THOMAS, IV, Forge Village, Mass.	———
McKONE, PETER JOSEPH, IV, Lowell, Mass.	29 Orleans Street
McNALLY, ALAN MARTIN, IV, Lowell, Mass.	55 South Whipple Street
MERRILL, RICHARD DOUGLAS, VI, Lowell, Mass.	364 Varnum Avenue
MORRIS, DONNA LOUISE, IV, Lowell, Mass.	40 Livingston Avenue
MURPHY, GEORGE CAMPBELL, IV, Buffalo, N. Y.	22 Fourth Street
MURRAY, ARDELLE MAY, VI, Lowell, Mass.	1535 Middlesex Street
O'DONNELL, JAMES FRANCIS, IV, North Chelmsford, Mass.	———
O'FLAHAVAN, JAMES MICHAEL, IV, Lowell, Mass.	62 Colonial Avenue
PENNER, STUART EMANUEL, IV, Lawrence, N. Y.	53 Nesmith Street
PERRY, WALTER HOLDEN, IV, North Andover, Mass.	———
REYNOLDS, JAMES MICHAEL, IV, Lowell, Mass.	3 Concord Place
ROUGHAN, JOHN MICHAEL, IV, Lowell, Mass.	176 Andover Street
SPOFFORD, RAY MILTON, VI, Haverhill, Mass.	———
WALL, JAMES THOMAS, VI, Lowell, Mass.	157 Pleasant Street
WIELICKA, EDWARD DOMINIC, IV, Lawrence, Mass.	———

Class of 1949 — Entering September 1945

Home Address	*Lowell Address*
Affler, Manuel, VI, Montreal, Que.	30 Windsor Street
Blagman, Burton, IV, Brooklyn, N. Y.	43 Plymouth Street
Brassil, Robert Daniel, IV, Lowell, Mass.	404 Wentworth Avenue
Chan, Ping-Chao, VI, Kunming, China	43 Plymouth Street
Conlon, William Henry, Jr., IV, Lowell, Mass.	101 Walker Street
Craven, Frank Joseph, IV, Lowell, Mass.	620 School Street
Daly, John Joseph, VI, Lowell, Mass.	118 West Sixth Street
Deminie, William Frederick, IV, Amesbury, Mass.	———
Dulack, Joseph Thomas, Jr., VI, Somersville, Conn.	222 Varnum Avenue
Eliyesil, Mehmed Can, VI, Tarsus, Turkey	5 White Street
Fanning, Leo Francis, VI, Moosup, Conn.	298 Riverside Street
Favro, Gilbert James, IV, Lowell, Mass.	19 Potter Street
Feltheimer, Arthur Murray, VI, Bronx 60, N.Y.	123 Riverside Street
Field, Marvin Joseph, VI, New York, N. Y.	123 Riverside Street
Fraser, Richard Warren, VI, Melrose, Mass.	43 Plymouth Street
Giglio, Frank Antonio, V, Brooklyn, N. Y.	9 Dunbar Street
Glickman, Daniel, IV, Brookline, Mass.	272 Merrimack Street
Gottlieb, Seymour, VI, Brooklyn, N. Y.	59 Arlington Street
Grover, Marvyn Hirsh, VI, Westmount, Que.	137 Riverside Street
Gunther, Marilyn Katherine, IV, Dracut, Mass.	———
Harrison, Robert Arthur, VI, Brookline, Mass.	1123 Middlesex Street
Haskel, Simon Aaron, VI, Brooklyn, N. Y.	38 Florence Avenue
Herrick, Richard Davis, VI, Ipswich, Mass.	43 Plymouth Street
Judge, Henry Bernard, Jr., IV, Lawrence, Mass.	———
Keeney, John Henry, VI, Somersville, Conn.	137 Riverside Street
King, John Michael, Jr., VI, Lowell, Mass.	158 Howard Street
Kosartes, Marina, VI, Lowell, Mass.	1036 Middlesex Street
Lachut, Herbert Michael, IV, Dracut, Mass.	161 Lakeview Avenue
Levine, Julius, IV, New York, N. Y.	38 Florence Avenue
Liverant, Manfred, VI, Montreal, Que.	2 Bellevue Street
Luz, Victor James, VI, Lowell, Mass.	1122 Gorham Street
McHugh, Thomas Francis, VI, Fitchburg, Mass.	37 Varney Street
McKone, Henry James, VI, Lowell, Mass.	107 Mammoth Road
McMahon, Laurence Francis, IV, Lowell, Mass.	7 Belmont Street
Maguire, John Paul, VI, Lowell, Mass.	31 Prospect Street
Mitchell, Alvin Emery, IV, Warwick, R. I.	272 Merrimack Street
Mitchell, Richard Barnes, IV, Boston, Mass.	———
Morris, Edward Sharen, VI, Paterson, N. J.	2 Bellevue Street
Na, Chung-Sheng, IV, Kunming, China	43 Plymouth Street
Natter, Sidney, VI, Bronx, N. Y.	19 Waverley Street
Needle, Irwin Reuben, VI, Brooklyn, N. Y.	43 Plymouth Street
Nickerson, Howard Leslie, Jr., IV, Chelmsford, Mass.	———
O'Donnell, William Robert, VI, Lowell, Mass.	11 Hazeltine Street
Pantell, Ira Harry, VI, New York, N. Y.	43 Plymouth Street
Patterson, Donald Leonard, VI, Dracut, Mass.	———
Piekarski, William Fabian, IV, Lowell, Mass.	70 West Fourth Street
Piper, Paul Putnam, VI, Lowell, Mass.	78 Methuen Street
Renaux, Ingo Arlindo, VI, Brusque, Brazil	8 Mt. Washington Street
Richardson, Donald Forrest, VI, Lowell, Mass.	53 Dunfey Street
Riordan, Warren Paul, Jr., VI, Lowell, Mass.	21 Orchard Street
Squire, Charles, VI, West New York, N. J.	137 Riverside Street
Strobel, Richard Irving, Jr., IV, Lawrence, Mass.	———
Stuart, Henry Bond, VI, Whitinsville, Mass.	11 White Street

Home Address	*Lowell Address*
Sumar, Cesar Pacha, IV, Santiago, Chile	119 Sherman Street
Sweeney, James William, IV, Lowell, Mass.	14 Chambers Street
Teres, Howard Fred, VI, New York, N. Y.	77 Mt. Washington Street
Trommer, Charles Richard, IV, New York, N. Y.	392 Chelmsford Street
Vallincour, Dorothy Jeannette, VI, Lowell, Mass.	59 Foster Street
Weiner, Charles Richard, VI, Brooklyn, N. Y.	1123 Middlesex Street
Weinstein, Manuel, VI, Revere, Mass.	43 Plymouth Street
Wilbur, Earl Raymond, IV, Lowell, Mass.	172 Shaw Street

Class of 1949 — Entering January 1946

Arnold, Peter Kent, VI, Saylesville, R. I.	66 Princeton Boulevard
Beckenstein, Leonard, VI, Brooklyn, N. Y.	107 Stevens Street
Berland, Norman Harvey, IV, New York, N. Y.	107 Stevens Street
Bill, Walter Edgar, IV, Lowell, Mass.	64 Foster Street
Blackman, Harvey Bernard, IV, Brockton, Mass.	115 Foster Street
Britton, Edward Joseph, VI, Lowell, Mass.	47 Lundberg Street
Brownell, Charles Baxter, IV, Sterling Junction, Mass.	98 Westford Street
Burgess, Philip Bradford, IV, Grafton, Mass.	R.F.D. No. 1, N. Tewksbury, Mass.
Charatz, Milton, IV, Brooklyn, N. Y.	65 Bellevue Street
Cherowbrier, Edward, Jr., IV, Methuen, Mass.	————
Chwalek, Frank John, IV, Lawrence, Mass.	————
Coffey, John Francis, VI, Lowell, Mass.	121 Pawtucket Street
Colman, Alexander Herman, VI, Manhattan, N.Y.	180 Princeton Boulevard
Conlon, William Joseph, VI, Lawrence, Mass.	————
Davis, James Edward, VI, Toronto, Ont.	32 Orchard Street
DeAngelis, Louis Paul, VI, Old Forge, Pa.	138 Westford Street
Dougherty, Wilbur Edgehill, VI, Lowell, Mass.	131 Upham Street
Dulken, John Frederick, VI, Montclair, N. J.	66 Princeton Boulevard
Eisenwinter, Lemuel Whitney, V, Watertown, Conn.	29 Kirk Street
Fecteau, Paul Emile, VI, Lawrence, Mass.	————
Feinberg, Bertram, VI, Forest Hills, N. Y.	180 Princeton Boulevard
Fendler, Rudolph, VI, Roxbury, Mass.	————
Fishman, Maurice, IV, Roxbury, Mass.	91 Methuen Street
Foley, William Matthew, IV, Lowell, Mass.	120 Fulton Street
Fox, Richard Coleman, VI, Lowell, Mass.	27 Royal Street
Freeman, Robert Herbert, IV, Brooklyn, N. Y.	38 Florence Avenue
Frenette, Roland Joseph, VI, Lowell, Mass.	139 Alma Street
Friedlander, Robert, VI, Brooklyn, N. Y.	22 A Street
Fruchtman, Gerald Gary, VI, Brooklyn, N. Y.	77 Mt. Washington Street
Gardner, Lawrence Carroll, IV, Lowell, Mass.	48 Sutherland Street
Gilchrest, Dexter Stuart, VI, South Hamilton, Mass.	————
Godet, John Russell, IV, Lowell, Mass.	71 Agawam Street
Greenberg, Bernard, IV, Brooklyn, N. Y.	25 Princeton Boulevard
Greene, Philip Leon, VI, Brooklyn, N. Y.	61 Twelfth Street
Guggenheim, Leopoldo Levi, VI, Santiago, Chile	15 Douglas Road
Handy, William Lafayette, VI, Longmeadow, Mass.	53 Mt. Hope Street
Harvey, Clifford Arthur, IV, Lowell, Mass.	4 Dane Street
Huff, Thomas Augustus, VI, West Coast, B. C.	55 Parkview Avenue
Johnson, William Warren, V, Short Hills, N. J.	27 Fairfield Street

Home Address	*Lowell Address*
Jones, Richard Bradley, VI, Hingham, Mass.	84 Methuen Street
Kane, James Francis, VI, Lowell, Mass.	37 Unsworth Street
Kaufman, David Leonard, V, Brooklyn, N. Y.	91 Methuen Street
Kenniston, George Demeritt, IV, Lowell, Mass.	67 Loring Street
Kervin, Forrest Elvin, VI, Lowell, Mass.	151 Moore Street
Koksal, Lutfi, VI, Istanbul, Turkey	29 Burtt Street
Kormos, Peter Marion, VI, New Brunswick, N.J.	129 Church Street
Krivis, Ernest, VI, Allston, Mass.	52 Princeton Boulevard
Kyriacou, Demetrios, IV, Lowell, Mass.	26 Varney Street
Leshinsky, Seymour Leon, VI, Bronx, N. Y.	61 Twelfth Street
McGuire, David Lewis, VI, New London, Conn.	22 Twelfth Street
Manning, Edward Nicholas, IV, Cambridge, Mass.	———
Martin, James Francis, VI, Lowell, Mass.	53 Fay Street
Mendrala, Edward John, IV, Thompsonville, Conn.	305 Nesmith Street
Norris, Frank Thomas, IV, Holyoke, Mass.	9 White Street
O'Donnell, Thomas Francis, Jr., VI, Lowell, Mass.	71 Canton Street
O'Toole, Martin Joseph, VI, Brighton, Mass.	———
Pfister, David Herbert, V, Lynbrook, N. Y.	27 Fairfield Street
Pinto, Americo Seabra Moura, VI, Rio de Janeiro, Brazil	20 Mansur Street
Polebaum, Eugene Harvey, V, Brooklyn, N. Y.	52 Princeton Boulevard
Reimer, Morton Sterling, VI, North Adams, Mass.	55 Parkview Avenue
Robison, Fred James, VI, North Wilmington, Mass.	———
Rosa, Manuel August, VI, Methuen, Mass.	———
Rothman, Alvin, VI, Brooklyn, N. Y.	52 Princeton Boulevard
Roy, Raymond Emile, IV, Lowell, Mass.	95 Jenness Street
Schwarz, Walter, VI, Elmhurst, N. Y.	27 Windsor Street
Scriven, John William, 3d, IV, Arlington, Mass.	———
Shapiro, Herman, IV, Chelsea, Mass.	———
Sheehan, Charles Russell, IV, Lowell, Mass.	150 Cross Street
Simon, Stanley Rissman, VI, Chicago, Ill.	272 Merrimack Street
Sokoloff, Joseph, VI, Brooklyn, N. Y.	117 Grand Street
Strickland, Robert Albert, IV, North Andover, Mass.	———
Sugg, Philip Willson, Jr., VI, Lisbon Falls, Me.	55 Parkview Avenue
Sweeney, Dennis John, VI, Brockton, Mass.	272 Merrimack Street
Viau, George Orlando, VI, Lowell, Mass.	12 Whitney Avenue
Volin, Irwin Jack, VI, Lawrence, L. I., N. Y.	53 Nesmith Street
Vomvouras, Paul, VI, Boston, Mass.	———
Weiss, Donald Stuart, VI, Bronx, N. Y.	25 Princeton Boulevard
Whitehead, Charles Andrew, VI, Dover, N. J.	5 White Street
Wholey, Joseph Arthur, Jr., VI, Lowell, Mass.	33 Starbird Street
Woodward, Paul Henry, VI, Lebanon, N. H.	392 Chelmsford Street
Young, William Arthur, VI, Toronto, Ont.	131 Varnum Avenue

DIPLOMA STUDENTS

Class of 1946

Bent, Robert Mace, Jr., II, Newton Center, Mass.	———
Nalbandian, Archavir Malkonian, II, Santiago, Chile	15 Douglas Road
Uriarte, Ignacio Daldini, I, Santiago, Chile	15 Douglas Road

Class of 1947

Home Address	Lowell Address
Boulay, Alice Elizabeth, III, Dracut, Mass.	———
Giffler, Bernard, II, Brooklyn, N. Y.	124 Appleton Street

Class of 1948 — Entering September 1945

Burns, Robert William, II, Whitefield, N. H.	19 Waverley Street
McCord, Douglas Duncan, III, Outremont, Que.	37 Varney Street
Mathieu, Robert Charles, II, Woonsocket, R. I.	5 White Street
Poblocki, Raymond Robert, II, Webster, Mass.	5 White Street
Stratton, Clifford Garnet, II, Amsterdam, N. Y.	272 Merrimack Street
Whittier, Nathaniel True, III, Milton, Mass.	53 Mt. Hope Street

Class of 1948 — Entering January 1946

Bates, William Charles, II, Neepawa, Manitoba	14 Oakland Street
Buerhaus, Robert Bronsdon, II, Needham, Mass.	84 Methuen Street
Dinan, Robert Joseph, I, Nashua, N. H.	———
Dole, Gordon Shattuck, II, Bristol, N. H.	138 Westford Street
Jones, Newton Browder, II, Sweetwater, Tenn.	17 Hidden Road, Andover
Kent, Ferrell George, I, Wakefield, Mass.	———
Kiser, Harry Worth, II, Abbeville, S. C.	67 Burtt Street
Lent, Roy Gordon, II, Maynard, Mass.	9 Dunbar Avenue
Pajah, Edward George, I, Ware, Mass.	272 Merrimack Street
Stavrakas, Evangelos, III, Brooklyn, N. Y.	107 Stevens Street
Wojtaszek, Aloysius Francis, III, Adams, Mass.	91 Methuen Street

SPECIALS

Blomberg, Gunnar Gustave, III, Milton, Mass.	———
Bullock, Ralph Louis, IV, Lexington, Mass.	———
Curry, Thomas Edward, 2d, II, East Greenwich, R. I.	4 Morton Street, Andover
Daroowalla, Aspi Doongaji, VI, Ahmedabad, India	55 Huntington Street
DeLong, William Edwin, II, Eldorado, Texas	382 East Merrimack Street
DeMenezes, Antonio Carlos Azevedo, I, Recife, Brazil	8 Mt. Washington Street
Dunn, Norbert John, II, Thompsonville, Conn.	9 Dunbar Street
Gladwin, Walter Jordan, II, Newton Lower Falls, Mass.	———
Grossman, Clinton, IV, Providence, R. I.	64 Tyler Park
Guise, Francisco Jose de Souza, I, Rio de Janeiro, Brazil	54 Pentucket Avenue
Harris, Richard, IV, Lowell, Mass.	95 Tyler Park
Hodgkins, Clifford Walter, II, Roxbury, Mass.	———
Hodgson, Joseph, II, Concord, N. H.	26 Crawford Street
Jarek, Julius, IV, Lowell, Mass.	74 Eleventh Street
Kennedy, Albert Elias, VI, Lowell, Mass.	118 Webber Street
Kisielewski, Joseph Louis, II, Webster, Mass.	252 Middlesex Street
Koo, Hsi Sheng, I, Ch'ungking, China	272 Merrimack Street
Kopycinski, Joseph Valentine, IV, Lowell, Mass.	242 Branch Street
L'Ecuyer, L. Paul, II, Winooski, Vt.	578 Merrimack Street
Little, Charles Nelson, II, Utica, N. Y.	55 Huntington Street

Home Address	*Lowell Address*
Liu, Yu-Hsuan, I, Sian, China	20 Walden Street
M.S., Massachusetts Institute of Technology	
McKew, Marshall, II, Troy, N. H.	222 Varnum Avenue
Maslanka, Edward John Felix, IV, Lowell, Mass.	5 Hampshire Street
Michelman, Isaac, II, Springfield, Mass.	34 Hawthorne Street
Peterson, Mendel Lazear, VI, Brookhaven, Miss.	582 Westford Street
Segal, Herbert Hinsch, III, Brookline, Mass.	———
Shroff, Bharat Chimanlal, III, Bombay, India	37 Varney Street
Sullivan, Charles Francis, II, Lowell, Mass.	27 Emery Street
Wilson, Charles Taylor, II, Ware, Mass.	———
Zintak, Benjamin Joseph, Jr., II, Chicago, Ill.	87 Nesmith Street

Class of 1949 — Entering May 1946

Alden, John, VI, Lowell, Mass.	45 Harvard Street
Bess, Leon, V, Paterson, N. J.	272 Merrimack Street
Derby, James Henry, IV, Lawrence, Mass.	———
Duffy, Joseph Gordon, IV, Lawrence, Mass.	———
Howland, Henry Talmadge, VI, Skaneateles, N. Y.	457 Westford Street
Lorberbaum, Alan Seymour, VI, New York, N. Y.	53 Nesmith Street
Pettengill, Warren Martin, VI, Cranston, R. I.	26 Huntington Street
Ramirez, Maximo Islas, VI, Mexico, D.F., Mexico	8 Mt. Washington Street
Rhodes, Max, IV, Jackson Heights, L. I., N. Y.	21 Huntington Street
Rosenthal, Theodore Alton, VI, Waterville, Me.	488 Pine Street
Rubenstein, Stanley, VI, Brooklyn, N. Y.	74 Huntington Street
Sayers, Thomas Martin, VI, Lowell, Mass.	27 Burtt Street
Schwartz, Martin Norman, VI, Brooklyn, N. Y.	20 Edson Street
Shapiro, Sumner, VI, Lowell, Mass.	37 Canton Street
Shaughnessy, John Andrew, IV, Lowell, Mass.	18 Puffer Street
Stroup, John Francis, Jr., IV, Dorchester, Mass.	21 Huntington Street
Sullivan, John Edward, VI, Lowell, Mass.	280 Beacon Street
Yumlu, Mustafa Ekrem, VI, Istanbul, Turkey	29 Burtt Street

Class of 1948 — Entering May 1946

Fieldsend, George Tom, II, Hudson, Mass.	30 Riverside Street

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BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1946-1947

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Moody Street and Colonial Avenue

DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

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LOWELL EVENING TEXTILE SCHOOL

ADMINISTRATION AND FACULTY

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President.
Charles Holmes Eames, S.B. . . . . Billerica.
President Emeritus
Edgar Harrison Barker . . . . 9 Mount Hope Street.
Professor Emeritus of Textiles.
Louis Atwell Olney, S.B., M.S., ScD. . . . . . . 118 Riverside Street.
Professor Emeritus of Chemistry
Hermann Henry Bachmann . . . . . . 146 Parkview Avenue.
Professor Emeritus of Textile Design
Lester Howard Cushing, A.B., Ed.M. . . . . . 25 Nicollet Street.
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Herbert James Ball, S.B., B.C.S., F.T.I. . . . 34 Pentucket Avenue.
Professor of Textile Engineering; in charge of Department of Textile Engineering and Accountancy.
Gilbert Roscoe Merrill, B.T.E. . . . . 364 Varnum Avenue.
Professor of Textiles; in charge of Department of Cotton Yarns and Knitting.
Cornelius Leonard Glen . . . . R.F.D. No. 1, Lowell.
Professor of Textiles; in charge of Department of Finishing.
Russell Lee Brown, B.T.E., M.S. . . . . . 59 Bradstreet Avenue.
Professor of Textiles; in charge of Department of Wool Yarns.
Elmer Edward Fickett, B.S. . . . . 162 Hovey Street.
Professor of Chemistry; in charge of Department of Chemistry and Textile Coloring.
Vittoria Rosatto, B.S. . . . . 63 Bradstreet Avenue.
Professor of Textile Design; in charge of Department of Design and Weaving.
Stewart Mackay . . . . North Chelmsford.
Assistant Professor in Textile Design Department.
John Charles Lowe, B.T.E., M.S. . . . . . . 229 Dracut Street.
Assistant Professor in Wool Department.
Martin John Hoellrich . . . . . . 30 Saxonia Avenue, Lawrence.
Assistant Professor in Weaving Department.
Harold Canning Chapin, Ph.D. . . . . 290 Pine Street.
Assistant Professor in Chemistry and Dyeing Department.
Charles Lincoln Howarth, B.T.C. . . . . North Billerica.
Assistant Professor in Chemistry and Dyeing Department.
Harry Chamberlain Brown, S.B. . . . . . 272 Merrimack Street.
Assistant Professor in Textile Engineering Department.
James Guthrie Dow, A.B. . . . . 11 Robbins Street.
Assistant Professor in Language Department.
A. Edwin Wells, B.T.E., Ed.M. . . 37 Ashland Street, Melrose Highlands.
Assistant Professor in Textile Engineering Department.
James Harrington Kennedy, Jr., B.T.E., M.S. . . . Florence Avenue.
Assistant Professor in Wool Department.
Charles Frederick Edlund, B.S., Ed.M. . . . 272 Merrimack Street.
Assistant Professor in Textile Engineering Department.
John Henry Skinkle, S.B., M.S. . . . . Chelmsford.
Assistant Professor in Chemistry and Dyeing Department.
Horton Brown, B.S. . . . . . . 178 Atlantic Avenue, Marblehead.
Assistant Professor in Textile Engineering Department.
Winford Sykes Nowell, B.M.E. . . . . . 8 Fulton Street, Methuen.
Assistant Professor in Finishing Department.
Nathaniel Erskine Jones . . . . 19 Maryland Avenue
Assistant Professor in Cotton Department
Russell Metcalf Fox . . . . 359 Beacon Street.
Assistant Professor in Textile Design Department.
Charles Arthur Everett, B.T.C. . . . . Chelmsford.
Assistant Professor in Chemistry and Dyeing Department.
William George Chace, Ph.B., M.S. . . . . Westford.
Assistant Professor in Chemistry and Dyeing Department.
John Leslie Merrill, B.T.E. . . . . . . 2026 Middlesex Street.
Assistant Professor in Weaving Department.

Milton Hindle, B.T.E. . . .	25 Thurston Road, Melrose Highlands.
Assistant Professor in Textile Engineering Department.	
Paul Charles Panagiotakos, S.B., Ph.D.	290 Branch Street
Assistant Professor in Chemistry and Dyeing Department.	
Charles Harrison Jack	68 Canton Street.
Instructor in Textile Engineering Department.	
Ruth Foote, A.B., S.B.	46 Victoria Street.
Instructor and Registrar.	
Waldo Ward Yarnall, B.S.	(On leave of absence)
Instructor in Physical Education.	
Charles Lincoln Daley, B.T.C.	64 Tyler Park.
Instructor in Chemistry and Dyeing Department.	
Paul David Petterson	East Chelmsford.
Instructor in Textile Engineering Department.	
Henry Leland Pero, B.T.E.	Chelmsford.
Instructor in Wool Department	
Elliot Flagg Humiston, S.B.	584 Westford Street.
Instructor in Textile Engineering Department.	
John Alden Goodwin, B.T.E.	111 Chestnut Street.
Instructor in Cotton Department.	
George Gordon Armstrong, Jr.	26 Adams Street, Littleton.
Instructor in Weaving Department.	
Henry Edward Thomas, B.T.E.	779 Westford Street.
Instructor in Textile Engineering Department.	
Elmer Percy Trevors	18 Rhodora Street.
Assistant Instructor in Chemistry and Dyeing Department.	
Florence Moore Lancey	46 Victoria Street.
Librarian.	
Helen Gray Flack, S.B.	445 Stevens Street.
Executive Secretary.	
Wallace Cochrane Butterfield, B.S.	272 Merrimack Street.
Bursar.	
Mona Palmer MacKenzie	1424 Bridge Street, Dracut.
Clerk.	
Theresa Dora LeBlanc	86 White Street.
Clerk.	
Thais Jacqueline Preble	236 Rogers Street.
Clerk.	
Patricia May Thompson	183 Methuen Street.
Clerk.	

CALENDAR—1946

September 26, Thursday	Registration
October 3, Thursday	Registration
October 7, Monday	Opening of evening school
November 11, Monday	Armistice Day — Holiday
November 21–22, Thursday and Friday . .	Thanksgiving Recess. No classes
December 20, Friday	End of first term

1947

January 6, Monday	Opening of second term
March 7, Friday	Closing of evening school

GENERAL INFORMATION

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits

All evening courses are free to residents of Lowell, but students must file a certificate of residence signed and sealed by the city clerk of Lowell. Those who do not file such certificate will be considered non-residents.

To non-residents of Lowell the fee is $10 per year for *each course of two nights per week*. Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, are required to make a laboratory deposit of $10 for any of the Chemistry courses with the exception of first year, Course 411. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows. All courses are held two evenings each week unless otherwise specified.

COTTON DEPARTMENT

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

111. Cotton Yarns—2 Years

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made. *Two evenings each week.*

Cotton.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cotton desired and securing delivery at a known price.

Opening and Picking.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Drawing.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

Roving.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

Ring Spinning.—A study of the various types of yarns gives the student an appreciation of the necessary characteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studied in detail. Important machine parts, such as guides, travelers, rings and builders, their adjustment and care, form an important part of this subject. Yarn faults and defects are shown and their causes explained.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

113. Knitting—1 Year

This is a general course on the manufacture of knitted fabrics and garments, intended for those interested in the principles of knitting and a study of the mechanisms of a variety of knitting machines. The more important phases of the course are:—

Yarns and Yarn Sizing Systems.—In order that the student may understand the distinctions between yarns, terminology, and the various sizing systems commonly used, several lectures are devoted to yarn characteristics and sizing as a basis for the entire course. This covers cottons, woolens, worsteds, silks and rayons.

Flat Machines.—These relatively simple machines make a fine starting point in establishing clearly the action of the latch needle and how it is operated. Lamb, Dubied, Grosser, and Links and Links machines are used as a basis for this part of the work.

Small Circular Ribbers.—These machines are a very logical step, following flat machines. Brinton, Wildman, and Universal ribbers, with different pattern mechanisms, are used in illustrating this type of work.

Automatic Hosiery Machines.—This section of the course is built around the various Banner and the Scott and Williams half and full hose machines. Most of the work is done with the plain machines as there is not sufficient time to include the fancy pattern type.

Large Ribbers and Spring Needle Machines.—Underwear fabric and webbing

are produced on this type of equipment. Scott and Williams, Wildman, Tompkins and Crane machines are the basis for instruction along these lines.

Full Fashioned Machine.—A brief study of the full fashioned principles and actions is based on the Reading 18-section machine in the laboratory.

Warp Knitting.—Using the Raschel machine in the laboratory, a general study of warp knitting includes Tricot and Milanese work also.

Analysis.—During the study of the various machines, considerable attention is given to the many "stitches" possible. This, coupled with the lectures on fabric and hosiery analysis, covers the common analysis problems.

Routines.—The usual sequence of manufacturing processes for hosiery and underwear are studied with the idea of illustrating the steps necessary in producing different articles.

Most of the instruction in this course is given by lectures. As many of these machines are small, it is common practice to bring the machine under discussion into the classroom so that students may see the machine and parts being considered. In other instances, the class may go into the laboratory to see the equipment and its operation.

114. Cotton Organization—1 Year

This course, offered only to those who have completed the work in Carding and Spinning, is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

WOOLEN AND WORSTED DEPARTMENT

211. Woolen Yarns—2 Years

Instruction during the *first year* covers grease wool classification with shrinkage determination methods, marketing methods, hair fibers, wool waste types, wool opening, scouring, and carbonizing; synthetic fibers of all types; rag and reworked fiber processing and classification.

One evening each week

During the *second year* instruction is given in full detail in blending of fibers, both natural and synthetic, oiling, picking, carding, spinning and twisting as woolen yarns.

218. Worsted Yarns—2 Years

Instruction covers clean wool blending for correct top grades, worsted carding, backwashing, open and intersecting gilling, Noble and French combing, top classification and marketing; synthetic fiber tops by combed and cut tow methods.

One evening each week.

The work of the *second year* is covered by instruction in top array classification, all details of Bradford drawing, spinning and twisting, and French drawing, spinning and twisting into worsted yarns; synthetic fiber manipulation; mill organization.

TEXTILE DESIGN AND WEAVING DEPARTMENT

311. Cotton Design—3 Years

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quilting, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

312. Woolen and Worsted Design—3 Years

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

313. Decorative Art—3 Years

During the first ten weeks the work consists of charcoal drawing from plaster models and group arrangements of still life. The second ten weeks deals with pastel drawing of still life groups, depending upon the progress and interest of the students.

During the *second year* instruction is given in figure drawing from the model.

In the *third year* the student chooses one of the following options:

1. Color Harmony—its mixes and uses.
2. Perspective—a mechanical method of correct drawing.

314. Show Card Design—2 Years

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

316. Pattern Alteration—1 Year

This includes a general understanding of the alteration of the commercial pattern as well as alterations for the student's own figure problems.

321. Cotton Weaving—1 Year

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

324. Loom Fixing—1 Year

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

CHEMISTRY AND DYEING DEPARTMENT

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. General Chemistry—2 Years

Includes Inorganic, Organic and Qualitative Analysis.

The *first year* work consists of two lectures and two recitations per week in Inorganic Chemistry.

During the *second year*, the classroom work is on the hydrocarbons and their derivatives. The laboratory work in Qualitative Analysis takes up, as thoroughly as time will permit, the qualitative detection of the more common metals and nonmetals. This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Three evenings each week.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Chemical Technology of Fibers.—This course consists of a series of lectures on the origin, composition and processing of the natural fibers; also the manufacture and properties of the artificial fibers. The chemical and physical properties of the fibers which influence their suitability for textile uses are emphasized. The following outline suggests the scope of the course:

Classification of fibers by origin, by importance and by chemical composition; properties necessary in a successful textile fiber; chemistry of cellulose, cotton, flax, ramie, jute, hemp, kapok; chemistry of proteins, silk, tussah, wool, reclaimed wool, mohair, other hairs; asbestos; manufactured fibers — history, production of filament and staple fiber, methods of delustering, manufacture of high tenacity yarns, details of manufacture of acetate, cupra, viscose, casein, vinyl, and nylon fibers, comparison of the manufactured fibers with each other and with comparable natural fibers.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching; carbonizing; silk-scouring and bleaching.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods of detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Talbot's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and "Commercial Methods of Analysis" by Snell and Biffen is used as a text.

414. Textile and Analytical Chemistry—4 Years

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

415. Chemistry and Technology of Leather—1 Year

Requirements: Two years of evening elementary chemistry and two years of inorganic quantitative analysis. A student without this preparative background or its equivalent will not be admitted to this course.

This is a one year course and treats of the chemistry and technology of leather manufacture. All the tannery processes are taken up with special emphasis on the purpose of each operation. In respect to the chemistry involved a short introduction to the chemistry of proteins and fats and the action of enzymes is presented, and the usual analytical methods are considered. Throughout the course mention is made of recent developments and fields of research.

The early part of the course consists entirely of lectures (three one-hour periods). The latter part consists of one weekly lecture and a two-hour laboratory session.

ENGLISH DEPARTMENT

511. English Composition—2 Years

First Year.—Remedial English and Rhetoric.—In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing in a certain way. This course is designed to give a comprehensive survey of necessary grammatical

and rhetorical principles. The course of instruction consists of lectures, recitations, remedial exercises, and the study of a text book.

One evening each week.

Second Year.—The Principles of Composition.—This is an advanced course and is not open to students who have not completed the first year or its equivalent. The primary purpose of this course is to give the student the ability to write clearly and correctly. An intensive study is made of the four divisions of composition—narration, description, exposition, and argumentation— and the art of letter writing. Selections from various authors to be read for general interest and for the purpose of illustration, are assigned for outside reading. Lectures are given; and home work, the study of a text book, and examinations are required.

One evening each week.

512. Appreciation of Literature—1 Year

This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

513. Industrial Psychology—1 Year

Guest Lecturer, Prof. Herman H. Brase.

In this course the psychologist helps the student apply to himself in industry the principles and facts of psychology. It recognizes the human element in production. Human relations effect not only the adjustments of the worker to his job and his fellow workmen, but also play a significant part in production. Psychology is no substitute for the "know how" but it can make the "know how" more effective, more pleasant and more profitable.

The fields treated in the course are—(1) Employment principle, (2) On the job training and growth, (3) Psychological factors in efficiency, (4) Psychological factors in safety, (5) Morale, getting the most out of your job.

The course is made up of lectures and discussion periods. The students are encouraged to bring in their own problems and observations.

TEXTILE ENGINEERING DEPARTMENT

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

The following courses are held two evenings each week, unless otherwise noted.

DRAWING

613. Mechanical Drawing—3 Years

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying

principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

638. Blue Print Reading—1 Year

This course is offered to those who wish only to be able to read drawings. While a fundamental knowledge of orthographic projection is desirable, it is not required. The course covers methods of projection, sections, dimensioning, and standard drawing practice. Blue prints of actual commercial drawings are used.

One evening each week.

MATHEMATICS

620. Mathematics—2 Years

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

631. Plane Geometry—2 Years

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

633. Shop Mathematics—1 Year

This subject deals with the practical application of mathematics which is of the greatest use to machinists or those in similar lines of work. It consists of those parts of arithmetic, algebra, geometry and trigonometry, which are essential in modern machine shop practice. Some of the topics are:—fractions and decimals, logarithms, problems in ratio and proportion, areas of surfaces, calculation of angles, solution of right and oblique triangles.

In addition to the mathematical work, the scientific principles which govern the operation of various machines are studied. In this connection the following topics are included:—verniers and micrometers, levers, belt and gear speeds, screw threads and screw cutting, gear tooth computations, plain and differential indexing. This subject requires home problem work and the study of a textbook.

ENGINEERING

614. Machine Shop Practice—2 Years

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, Shop Mathematics, Mechanics, and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

621. Strength of Materials—1 Year

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts

are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

622. Steam—1 Year

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

630. Mechanism—1 Year

This course deals with those principles which are used in the transmission of force and motion through machines and mechanical devices. It requires a knowledge of mechanics, and hence instruction will be given in the principles of uniform and accelerated motion, moments of force, and other topics in mechanics. The instruction in mechanism includes pulleys, belting, gears, gearing, cams and other devices. No student who is not thoroughly familiar with elementary mathematics should undertake this course. Home problem work and the study of a textbook are required.

632. Diesel Engines—1 Year

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

634. Air Conditioning—2 Years

The subjects covered in this course include the following; fundamental laws, principles and definitions; physical properties of the atmosphere; explanation of words and terms used, such as—matter, energy, heat, heat energy, temperature, ice, water, vapor, gas, steam, thermometers, hygrometers, hydrometers, barometers, pressure, gage pressure, absolute pressure, absolute temperature, laws of gases, heat units, vapor pressure, dew point, evaporation, condensation, precipitation, relative and absolute humidity; sensible heat, latent heat, specific heat, total heat of air, effective temperature, comfort zones, air movement, ventilation; movement of heat and air, infiltration, conduction, solar heat, air leakage; heat from human beings; lights, machinery and processes; humidification and dehumidification, heating and cooling, air filtration, air washing; refrigeration and refrigerants, cooling by water, ice, typical air-conditioning equipment, typical control equip-

ment, thermostats, humidostats, wet and dry bulb type; use of charts and tables, costs, etc.

Students are required to hand in complete details for producing prescribed conditions of temperature and humidity in some building in or near Lowell, Mass., before completing the course.

639. Textile Testing—1 Year

This subject is planned to present the fundamental knowledge required in determining the physical properties of textiles and the interpretation of the resulting data. So far as time permits the following topics form the basis of the lectures: textile fibers, their identification and properties; machines, equipment and procedures for determining breaking strength, elongation, fabric structure, tear resistance, bursting strength, crimp, twist, regain, air permeability, water resistance, thermal transmission, resistance to mildew, moths and fire, color fastness, abrasion, shrinkage; specifications, their sources and interpretation; statistical analysis of data.

In order to include some laboratory work, it is necessary to limit the size of the class to a maximum of ten qualified persons..

SALES

628. Selling and Advertising—1 Year.

This course covers the basic principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

ELECTRICITY

635. Practical Electricity—1 Year

The purpose of this course is to aid students who wish to advance themselves in any one of the electrical trades. The course will cover the underlying facts and laws of good electrical practice which the really well-informed and efficient workman must understand.

Lectures will be given one night each week on the following subjects: the nature of magnetism, Ohm's Law, simple electric circuits, combinations of series and parallel systems, wiring diagrams, electric bulbs and telephones. The practical part of the course, given one night each week, is divided into several experiments which will give the student a working knowledge of electrical wiring and installations.

636. Electrical Circuits and Machinery—2 Years

This course is planned to cover the fundamentals of electrical circuits and machinery. The lectures on electrical theory are supplemented by laboratory work, the use of a textbook, and the solution of problems. A considerable amount of home study and preparation are required. Students who wish to take this course must have studied one year of algebra.

The first year is devoted to the study of direct and alternating current circuits. The topics include Ohm's law, calculation and measurement of resistance, power, relation between electrical and other units of energy, magnetic fields, inductance, capacitance, and impedance of alternating current circuits.

The second year takes up the design and operation of direct and alternating current machinery. Part of the time is devoted to laboratory work to make the student familiar with methods of operating and testing electrical machinery.

640. Fundamentals of Electronics—2 Years

First Year.—Elements of Electrical Circuits. Study of Direct and Alternating Current Circuits. Topics include Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, inpedance of AC circuits. Part time is devoted to the laboratory for study of instruments in making circuit measurements.

Second Year.—FUNDAMENTALS OF ELECTRONICS. Vacuum tube theory, vacuum tube applications including rectifiers, power supplies, and amplifiers; classes of amplifiers; voltage-gain and power amplifiers; amplifier characteristics; electronic instruments.

641. Industrial Electronics—3 Years

First Year.—ELEMENTS OF ELECTRICAL CIRCUITS. Study of Direct and Alternating Current Circuits. Topics include Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance of AC circuits. Part time is devoted to the laboratory for study of instruments in making circuit measurements.

Second Year.—FUNDAMENTALS OF ELECTRONICS. Vacuum tube theory, vacuum tube applications including rectifiers, power supplies, and amplifiers; classes of amplifiers; voltage-gain and power amplifiers; amplifier characteristics; electronic instruments.

Third Year.—INDUSTRIAL ELECTRONICS. Tubes; theory and operating characteristics of photo-electric, both gas and vacuum tubes, and the thyratron. Amplifiers; resistance coupled, circuits, and applications to other than communication field. Electronic relays and timers; theory and circuit analysis of commercial DC and AC timers, relays and switches in timing devices, and applications to industry. Light sensitive control equipment; light sources, simple photo-electric relays, amplifiers and phototube combinations, commercial type photoelectric relay. Thyratron applications; phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Electronic heating devices; oscillators, circuit components, commercial applications. About one-third of the time will be devoted to laboratory work.

642. Principles of Radio—3 Years

First Year.—ELEMENTS OF ELECTRICAL CIRCUITS. Study of Direct and Alternating Current Circuits. Topics include Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance of AC circuits. Part time is devoted to the laboratory for study of instruments in making circuit measurements.

Second Year.—FUNDAMENTALS OF ELECTRONICS. Vacuum tube theory; vacuum tube applications including rectifiers, power supplies, and amplifiers; classes of amplifiers; voltage-gain and power amplifiers; amplifier characteristics; electronic instruments.

Third Year.—PRINCIPLES OF RADIO.—Audio systems including telephones, microphones, loud speakers; electro-magnetic transmission and radio propagation including waves, antennas, transmission lines; amplitude modulation communicating systems; vacuum tube applications in radio transmitters, modulators, detectors; radio receivers, including tracking and alignment; frequency modulation; electronic servicing instruments and equipment. One-third of the time is devoted to laboratory work.

643. Cathode Ray Oscilloscope—3 Years

First Year.—ELEMENTS OF ELECTRICAL CIRCUITS.—Study of Direct and Alternating Current Circuits. Topics include Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance of AC circuits. Part time is devoted to the laboratory for study of instruments in making circuit measurements.

Second Year.—FUNDAMENTALS OF ELECTRONICS.—Vacuum tube theory; vacuum tube applications including rectifiers, power supplies, and amplifiers; classes of amplifiers; voltage-gain and power amplifiers; amplifier characteristics; electronic instruments.

Third Year.—CATHODE RAY OSCILLOSCOPE.—The theory of the cathode ray tube including elementary electron optics, block diagram, functions of the various elements, fluorescent screen, electrostatic and magnetic deflection. Study of sweep circuits and saw-tooth oscillators, wobbulators, and frequency modulators. Block

diagram of typical oscilloscope components and controls. Power supplies, deflection plate amplifiers, and oscilloscope circuits analyzed. Graphical analysis of action of horizontal and vertical plates in producing typical patterns on the screen. Laboratory application of the oscilloscope and auxiliary equipment, as far as time permits, in wave form study, frequency measurement, response curves, selectivity curves, distortion, phase angle, modulation, industrial circuit problems.

FINISHING DEPARTMENT

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulli. g soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

EVENING GRADUATES OF 1946

Certificates awarded as follows, April 2, 1946:

Knitting — One Year

James Thomas Simpson, Lowell

Wool and Top Making — One Year

George Henry Bourgault, Lawrence
John Clough, Lawrence
Marshall Gordon Grant, Salem Depot, N. H.
George Anthony Hreha, Clinton
Joel Eastman Morrill Leadbeater, Lowell
Joseph Emile Lemire, Lowell
James Millar, Jamaica Plain
August Fredrick Muller, Lowell
Raymond Paul Tremblay, North Chelmsford

Woolen Yarns — One Year

Donald Ferrario Carew, Lowell
Joseph Robert Davidson, North Billerica
Paul William O'Neil, East Chelmsford
Austin Addams Patch, Lowell
Herman Winway Weinhold, Methuen

Woolen and Worsted Weaving — One Year

Wilbrod Daigle, Lowell
Stafford Russell Gill, Lowell
Andrew J. McGowan, Lawrence

Woolen and Worsted Design — Three Years

Hilaire Josepth D'Auteuil, Methuen
Augustine Xavier Keleher, Methuen
George William Pierog, Lawrence
William Joseph Zbieg, Lowell

Decorative Art — Three Years

Evangeline Nancy Gekas, Lowell

Woolen and Worsted Finishing — One Year

Gerard Sleicher Chapin, Andover
Michael Leo Driscoll, Methuen
Ralph Seth Giffin, Jr., Lowell
John Henry Hargreaves, Lawrence
George Francis McAllister, Methuen
George William Pierog, Lawrence
Axel Victor Swenson, Lowell

English Composition — Two Years

Lucy Rose Beati, Lowell
Maria Katherine Doyle, Lawrence
George Elden Morgan, Lowell

General Chemistry — Two Years

Daniel Anthony Cappiello, Lawrence
Doris Eva Desrochers, Amesbury
Stephen Webster Dyer, Jr., Lawrence
Ann Theresa Muller, Lowell
Milton Joseph Williams, Lowell

Textile Chemistry and Dyeing — Three Years

Edouard Gerard Bernier, Lowell
Stephanie Wanda Lach, Lowell

Analytical Chemistry — Three Years

James Joseph Gordon, Andover

Blue Print Reading — One Year

James Angelos Andros, Lowell
Frederick Stephen Castles, Lowell
Louis Ludger Dionne, Lowell
Richard Levesque, Nashua, N. H.
Henry Joseph Poitras, Lowell
John Leeland Taylor, Nashua, N. H.

Mathematics — Two Years

Jeanne Marie Champagne, Lowell
John Robert Johnson, Lowell
Donald Matti Maki, Milford, N. H.
Edward Joseph Simonian, Lowell

Textile Testing — One Year

Roy Fitzpatrick, Manchester, N. H.
Beatrice Veronica Hood, Lawrence
John Albert Ross, Amesbury
Royal Allison Roulston, Salem, N. H.
Wilfred Andrew Senechal, Lowell
Charles Howard Wittmann, Manchester, N. H.

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HEAT TRANSMISSION OF FABRICS BETWEEN PARALLEL METAL PLATES

By HARRY C. BROWN, S.B.*

Introduction

The heat transmittance of a textile fabric can be determined for at least three conditions: (1) both sides of the fabric exposed to air, (2) one side of the fabric exposed to air and the other in contact with a solid surface, (3) both sides of the fabric in contact with solid surfaces. Many methods have been devised and many kinds of apparatus have been designed to make such determinations.

On account of its simple construction and ease of manipulation, the Cenco-Fitch heat conductivity apparatus[1] is found in many testing laboratories. It was designed by Professor A. L. Fitch to measure the thermal cronductivities of thin plates of materials of low conductivity.[2] The material is placed between two parallel metal plates and it is recommended[3] that a heavy weight be used to produce pressure and give a good thermal contact. Such a procedure is unsuitable for textile fabrics because their thermal characteristics are greatly affected by deformation.

The following paper describes an attachment designed so that the apparatus is better adapted to measure the heat transmittances of fabrics. A discussion of the theory involved and experimental results with the modified apparatus are also included.

Description of Apparatus

The Cenco-Fitch apparatus has been described in many places.[4] It consists of two parts (Figure 1). The upper part has a cylindrical container with a copper plate (A) at the bottom, which acts as a source of heat. The lower part of the apparatus consists of a copper plate or block (B) surrounded by insulating material and is normally the heat receiver. The adjacent surfaces of the plates are nickel-plated and should be smooth, flat, and parallel to each other. The material to be tested is placed between the plates.

The upper plate is maintained at a constant temperature by electric heaters immersed in water in the cylindrical container. It is well to have excess heating capacity in order to heat the water quickly. Two 200-watt immersion heaters with a 44-ohm variable rheostat in series with one of them are used for this purpose.

The lower plate or heat receiver is initially at the temperature of the testing room and the temperature difference between it and the upper plate is measured by a thermocouple with junctions embedded in the plates. A microammeter with a capacity of at least 10 microamperes is a very convenient instrument for measuring the thermo-electric current.

For testing textile fabrics, the conductivity apparatus obtained from the manufacturer is mounted on a steel plate (D), 8½" x 7½" x ⅜" (See Figure 1). The top of the plate is accurately ground to a plane surface. Three vertical steel rods, each ⅜" in diameter, are fastened to the plate and each rod has a micrometer thread (pitch = .025") at the upper end. Three small spur gears (32T-32P) with threaded holes turn on the rods, the hubs of the spur gears serving as supports for a brass ring (C) which is clamped to the upper part of the apparatus. A thin

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[1] Central Scientific Company, Catalogue J-136, pg. 1226

[2] A. L. Fitch, A New Thermal Conductivity Apparatus, The American Physics Teacher, vol. 3, no. 3, pg. 135, 1935

[3] Selective Experiments in Physics, Central Scientific Co.—Thermal Conductivity, pg. 3

[4] Preceding references and E. R. Schwarz, Rayon Textile Monthly, vol. 21, pgs. 563-565, 637-638, 1940

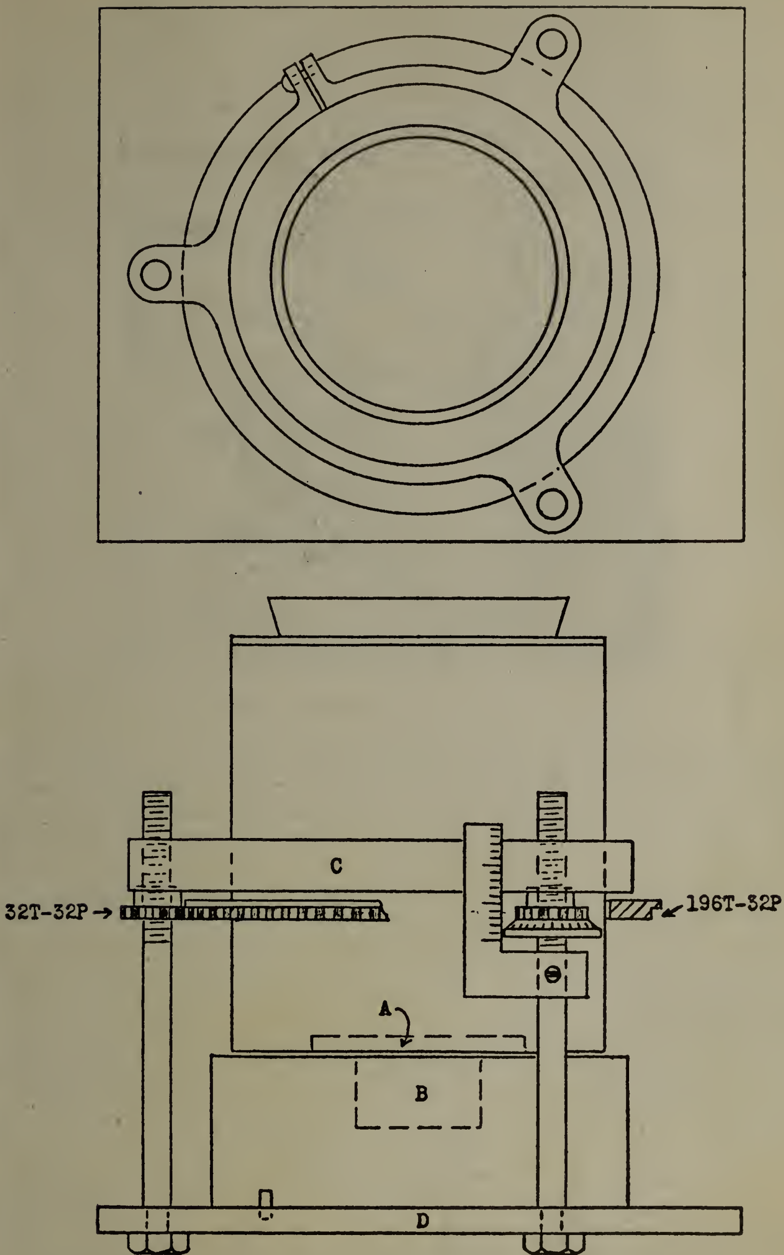

FIGURE 1. ATTACHMENT FOR CONDUCTIVITY APPARATUS

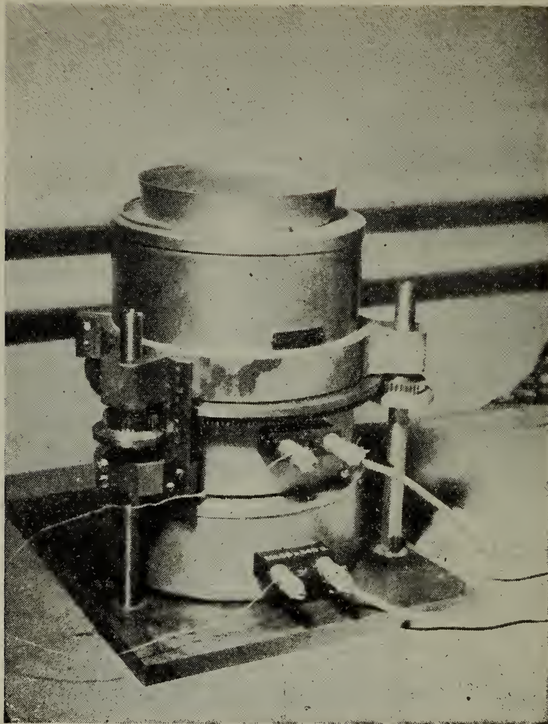

FIGURE 2. HEAT CONDUCTIVITY APPARATUS

strip of paper placed between the brass clamp and the metal container provides electrical insulation. The three spur gears are connected by a 196T-32P spur gear in the form of a ring which surrounds the apparatus.

The upper part of the apparatus is raised or lowered by turning a knurled disc attached to one of the spur gears (not shown in the sketch). The distance between the plates of the apparatus is very accurately measured by the aid of a vertical scale attached to one of the support rods. The scale contains 40 accurately marked divisions per inch and a disc attached to the adjacent spur gear has 25 divisions on its circumference. The two scales are read in the same manner as a micrometer and the reading indicates the distance between the plates to .001″.

The lower part, containing the heat receiver, can be easily removed from its usual position for the purpose of cooling and for the insertion of a new test sample. When it is returned, it is accurately centered by means of two metal pins fastened to the base plate.

Theoretical Discussion

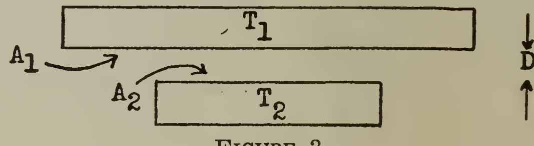

FIGURE 3

Consider two parallel plates separated by an air gap of D centimeters, and at different temperatures, T_1 and T_2 (Figure 3). If the distance D is very small (.01″) and T_1 is greater

than T_2, the effect of convection is probably negligible and the heat transmission between the plates is by conduction and radiation. Measurements made with T_2 greater T_1 show no increase in heat transmittance for the same difference of temperature indicating that convection does not exist in narrow air gaps.

Assuming $T_1 = 100°$ C, $T_2 = 30°$ C, D = .0254 cm. (.01″), and using .0000648 (c.g.s. units) as the conductivity of air[5], the rate of heat conductance between the two plates is approximately .179 calorie per second per square centimeter.

The following equation[6] has been used for calculating the radiant heat exchange between parallel planes whose areas are large compared with their distance apart.

$$Q = 1.37 \left[\left(\frac{T_1}{1000}\right)^4 - \left(\frac{T_2}{1000}\right)^4\right] \left(\frac{1}{\frac{1}{e_1} + \frac{1}{e_2} - 1}\right)$$

where

Q = net gain of A_2 in calories per sec. per sq. cm.
e_1 = emissivity coefficient of A_1
e_2 = " " " A_2
T_1 & T_2 = temperatures °K

The calculated value of Q is only approximate due to uncertainties in the values of e_1 and e_2. Assuming a value of 0.5 for each (the surfaces are of slightly oxidized nickel), the value of Q is .005 calorie per sec. per sq. cm. for $T_1 = 100°$ C and $T_2 = 30°$ C.

The total heat transmittance by conduction and radiation is .179 + .005 = .184 calorie per sec. per sq. cm. for the assumed conditions. Actual measurements made with the apparatus previously described give a value of .218 calorie per sec. per sq. cm.

The greater part of heat transmittance across air gap is evidently due to conduction. For wider gaps (0.10″) measured values of heat transmittance are approximately one-third larger than the sum of the calculated values of conductance and radiant heat transfer, indicating the presence of convection.

When a fabric is placed between the parallel plates, the method of heat transmission becomes much more complicated. The amount of heat transmitted by conduction increases, a part of the radiant energy from one plate is transmitted by the fabric, another part is absorbed by one surface of the fabric conducted through the fabric and radiated again to be finally received by the other plate. Heat is also transmitted by the vaporization and condensation of moisture in the fabric. It is observed when thick fabrics are tested that moisture collects on the cold plate. This effect produces an error in the desired value of heat transmittance and can be decreased if necessary by reducing the temperature of the hot plate. A thermostat would then be required to control the temperature of the upper plate. Conduction by the fabric fibers and the enclosed air spaces largely determines the heat transmittance under these conditions, convection and radiation having very small effects.

According to the classical theory of heat conduction, the amount of heat conducted through a homogeneous medium is inversely proportional to distance. For this reason, coefficients of thermal conductivity for homogeneous materials are always expressed for one unit of thickness. In

[5] Handbook of Chemistry and Physics, Chemical Rubber Publishing Co. International Critical Tables, Vol. V, McGraw-Hill

[6] W. J. King, Mechanical Engineering July 1936 pg. 495

the case of fabrics where some of the heat may be transmitted by convection and radiation and both surfaces of the fabric are in the path of the transmitted heat, it is improbable that over all heat transmittance is inversely proportional to thickness. Figure 5 shows the relation between $\frac{1}{\text{distance}}$ and the heat transmittance of the air gap for the apparatus without a fabric between the plates. Similar results have been obtained with fabrics between parallel plates.[7] Coefficients of thermal transmittance of fabrics can not be calculated accurately for an assumed thickness of one unit by assuming that heat transmittance is inversely proportioned to thickness. Consequently the usual method of expressing coefficients of thermal conductivity should not be used. The use of a coefficient involving a temperature difference of one degree is justified only if heat transfer is proportional to temperature difference. This relation is evidently true for ordinary differences of temperature as will be shown later in Figure 4.

A convenient way to evaluate the heat transmittance of a fabric is to use a coefficient which includes all methods of heat transfer. The amount of heat transmitted through a square meter of fabric for a temperature difference of one degree Centigrade and during a time of one second is a measure of thermal transmittance. The use of the square meter instead of the square centimeter as the unit of area gives fewer decimal places in the coefficient and will give values ranging from about 0.5 to 40 for ordinary fabrics. Corresponding values of a coefficient expressed in English units of B.t.u. per hour per sq. ft. per °F will be approximately three-quarters (0.738) of the preceding metric values.

The calculation of heat transmittance is based upon the following derivation.

Let dH equal the amount of heat transmitted from the hotter to the cooler plate in time dt (Figure 3) and let K represent a coefficient of heat transmittance as described above and A_2 the area of the smaller plate in square meters.

$$dH = KA_2(T_1 - T_2)\ dt$$

The asssumption is made that heat transmittance is proportional to $T_1 - T_2$. The validity of this assumption will be seen later in the experimental results.

Also

$$dH = MSdT_2$$

where M = mass in grams of the plate acting as a heat receiver and S = its specific heat.

If all of the heat transmitted between the plates is utilized in raising the temperature of A_2

$$KA_2(T_1 - T_2)\,dt = MS\ dT_2$$

$T_1 - T_2$ is measured by a thermocouple so that the thermoelectric current

$$i = C\ (T_1 - T_2)$$

Eliminate T_1 and T_2 and integrate giving the equation

$$t = -2.303\ \frac{MS}{KA_2}(\log i - \log i_0)$$

Since i_0 (the initial thermoelectric current) can have a constant value, t is a linear function of log i and $-2.303\ \frac{MS}{KA_2}$ is the slope of the plot of log i and t.

[7] J. B. Speakman and N. H. Chamberlain, The Thermal Conductivity of Textile Materials and Fabrics, The Journal of the Textile Institute vol. xxi, no. 2, Feb. 1930.

To obtain the value of K it is necessary to determine experimentally the relation between i and t, plot log i and t, and determine the slope of the graph.

Then

$$K = -2.303 \frac{MS}{mA_2}$$

where m = slope expressed in the units used in plotting log i and t.

Determination of Transmittance

Instructions provided with the apparatus are modified as follows. The lower part of the apparatus is removed from its position under the source of heat. (If the receiver is warm from previous use, it is cooled to the room temperature by placing a metal container filled with cold water over the receiving surface.) When the water is at the boiling point in the upper container and the microammeter is reading slightly over 7 microamperes, the fabric is placed over the receiver which is then put beneath the heat source. The position of the upper vessel is quickly adjusted to produce the desired distance between plates. (Methods of determining the distance are discussed later.)

When the current is exactly 7 microamperes a stop-watch is started and readings of current observed every 3 minutes with the aid of a hand magnifier. The readings are recorded on semi-logarithmic paper (See Figure 4). One cycle of the logarithimic scale has a value of 10 inches.

After obtaining six points on the plot the test is discontinued and the value of K is calculated.

A straight line is drawn through the plotted points and the distance V is measured with a steel scale reading to .02″.

$$K = \frac{2.303\ Ms}{mA_2} \quad \text{(disregarding the negative sign)}$$

where $M = 340$ grams (mass of receiver)

$S = .093$ specific heat of copper

$A_2 = .00155$ sq. meter (area of receiver)

$m = \frac{10.H}{V}$ where $H = 21 \times 60$ seconds

V = distance read on steel scale in inches

$K = 3.73\ V$

$= (3.73)\ (2.97)$ (From Figure 4)

$= 11.1$ cal. per sec. per sq. meter per °C

Experimental Results

The following experiment was conducted with the apparatus described above. The distance between the plates was set at 0.100″ and heat transmittances were measured with (1) air only (2) a thin cotton fabric (3) a heavy worsted suiting between the plates. The distance of 0.100″ was chosen because it was slightly greater than the maximum thickness of either fabric and with the fabric resting on the lower plate there was a small air space between the upper surface of the fabric and the upper plate.

The results expressed in calories per sec. per sq. meter per °C were

(1)	Air	4.33
(2)	Cotton fabric	4.48
(3)	Worsted suiting	5.23

The results obtained confirm the fact that textile fibers are better conductors of heat than a dead air space. Neither fabric had any insulation value under the conditions of the test, the presence of the fabric actually increased the transfer of heat between the plates. Under these conditions the worsted suiting showed a greater heat transmittance than the thin cotton fabric.

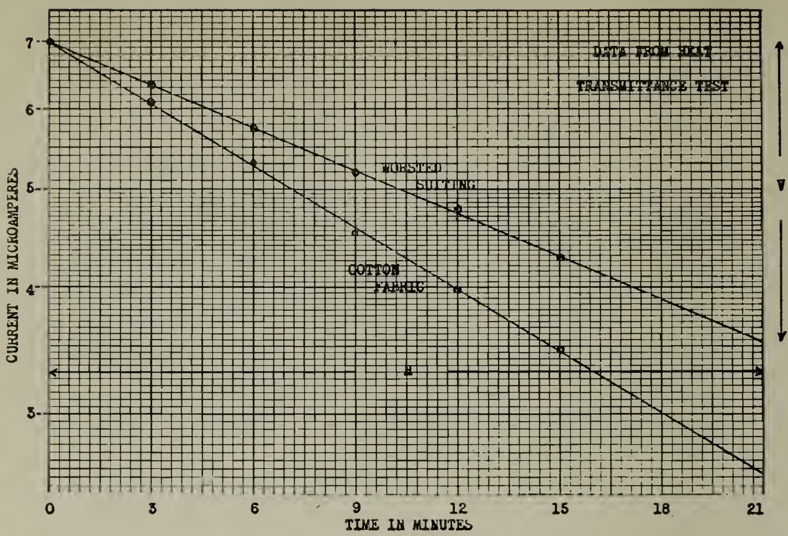

FIGURE 4

Hence it follows that it is quite impossible to test fabrics with a fixed distance between plates (greater than the fabric thickness) and obtain results which conform with practical experience in regard to heat insulating values.

In the next experiment, the cotton fabric was placed between the plates and the distance between them adjusted to produce a pressure of 1 gram per sq. cm. on the fabric. The heat transmittance was found to be 15.9; under the same pressure the worsted suiting gave a value of 11.1, these results being in accord with practical experience.

The desired pressure of 1 gram per sq. cm. was obtained with the aid of the compressometer designed by the U. S. Bureau of Standards.[8] A round thin plate of glass 6.88 cms. in diameter was placed on the fabric, the weight of the glass producing a total pressure of 20.3 grams. The foot of the compressometer was applied to the center of the glass plate to give an additional force of 16.9 grams. The total presure of 37.2 grams produced a unit pressure of 1 gram per sq. cm. The thickness of the fabric was obtained from the reading of the compressometer, the fabric was placed between the plates of the heat transmittance apparatus, and the distance between plates set at a distance equal to the measured fabric thickness.

A pressure of 1 gram per sq. cm. (0.0142 lb. per sq. in.) can be determined precisely by the method described. It is sufficient to insure contact between both plates and fabric but there is no appreciable deformation of the fabric even in the case of a fluffy material like a blanket. Although lower pressures have been used[9], this value might well be adopted as a standard for measurements involving the parallel plate method. It corresponds approximately to some conditions of actual use where fabrics are used as underclothing or as additional under blankets.

Heat transmittances of both fabrics were measured for pressures used in obtaining the standard thickness according to A.S.T.M. specifications. The results and other fabric details are found in Table 1.

[8] H. F. Schiefer, Bureau of Standards Journal of Research, vol. 10, pg. 705, 1933

[9] W. H. Rees, The Transmission of Heat through Textile Fabrics, The Journal of the Textile Institute, vol. XXXII, no. 8, T 149-165, 1941

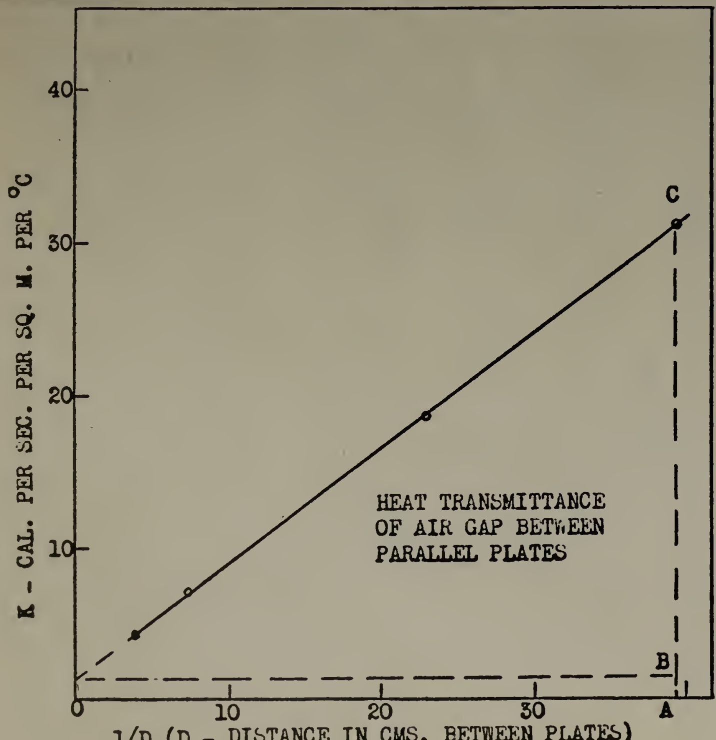

FIGURE 5

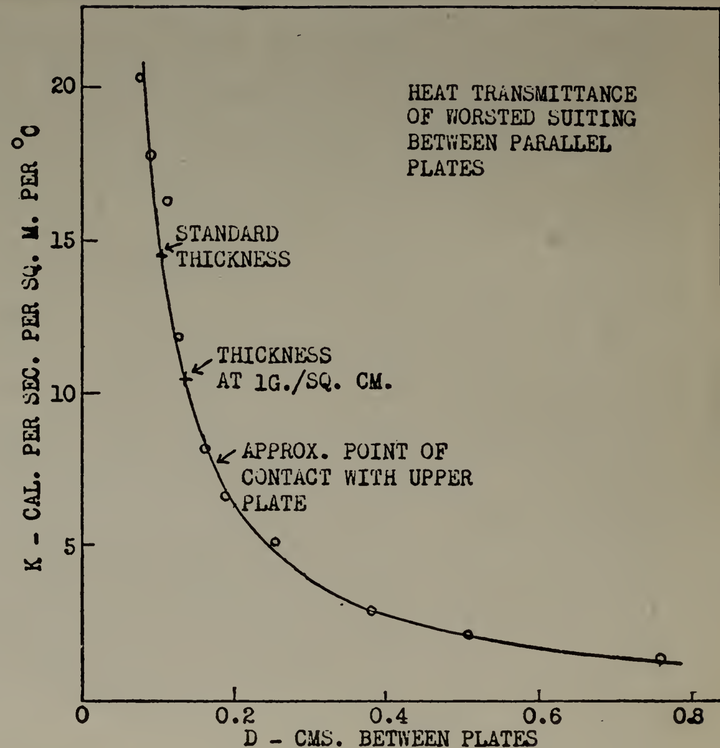

FIGURE 6

Table 1

Heat Transmittances

Fabric	Weight Oz. per sq. yd.	Thickness 1 gm./sq.cm. pressure	Thickness Standard	K—calories per sec. per sq. m. per °C. .100″ between plates	1 gm./sq.cm. pressure	Standard pressure
Cotton	3.84	.032″	.014″	4.48 (4.33)*	15.9 (11.5)	40.9 (21.7)
Worsted suiting	11.2	.053″	.037″	5.23 (4.33)	11.1 (8.65)	16.8 (10.0)

*—The numbers in parentheses are the heat transmittances of the corresponding air gaps with the fabric removed.

The relation between the heat transmittance with air only between the plates of the apparatus and the reciprocal of the distance is shown in Figure 5. The experimental results confirm the theoretical discussion (pg. 5) where it was calculated that the heat transfer consisted of a small amount of radiant energy (AB Fig. 5) which is independent of the distance between the parallel plates and a larger amount of conducted heat (BC) which decreases as the separation of the plates increases.

The effect of separation of plates and pressure on thermal transmittance is shown in Figure 6.[10] It is seen that small differences in the distance between the plates when they are in contact with the fabric and the corresponding change of pressure on the fabric produce large variations in the measured value of heat transmittance. Hence it is very important to determine and specify exactly the pressure on the fabric and the distance between the plates.

It is found that differences between the initial temperature of the heat receiver and its surroundings affect the measured rate of heat transmittance between plates in some cases. It is well to make all tests in a room of constant temperature and to cool the receiver and its container to the temperature of the room before taking a set of readings.

Summary

For measuring heat transmittances of fabrics by the parallel plate method, an accurate and convenient device is required to adjust and measure the distance (or pressure) between the plates. Such a device is described in detail on pages 2, 3 and 4.

The transmission of heat through a fabric between metal plates is mostly by conduction of the fibers and enclosed air spaces.

Heat transmittance may be well expressed in calories per second per square meter per degree centigrade.

With the apparatus described above, heat transmittance is calculated by simply multiplying 3.73 by the distance V (Figure 4) in inches.

A fabric has no insulating value when placed in a narrow gap between parallel metal plates. In all cases (Table 1) the measured heat transmittance with a fabric between the plates was greater than the corresponding air gap without the fabric.

Pressures employed in standard thickness measurements (239 grams per sq. cm.) are too large for ordinary measurements of heat transmittance on account of the excessive compression of the fabric.

A pressure of 1 gram per square centimeter is suggested as a standard for heat transmittance measurements by the parallel plate method.

The apparatus described will give reproducible values of heat transmittance for one set of conditions. Unless a method can be found for correlating values under all conditions, the parallel plate method is not adequate to give all necessary information concerning heat transmittance.

[10] Data taken from the master's thesis of Robert S. Dunn, Lowell Textile Institute, 1946

Conclusion

The writer is indebted to Professor Herbert J. Ball, head of the Textile Engineering Department, for valuable advice in preparing this paper and to Mr. C. Harry Jack and Mr. Paul D. Petterson of the same department for the machine work on the apparatus.

Southwick Hall | Louis Pasteur Hall

SERIES 50, No. 4 May, 1947

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Textile and Colonial Avenues

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M. Lydon	1948

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E. L. Golec	1947
M. Lydon	1947
E. P. James	1948
J. C. Lowe	1948
G. R. Merrill	1948
Vittoria Rosatto	1948
C. L. Daley	1949
R. B. Oliver	1949
H. E. Thomas	1949

HISTORICAL SKETCH OF THE LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio.* Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its method of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space.

The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The courses for those students who can attend the day classes are organized to prepare them to enter some one of the various branches of the textile industry. It is required that all such students shall have an educational background equivalent to that of a complete college preparatory course as given by a recognized high school or academy. These textile courses are of four years duration and are described in detail on the following pages of this catalogue.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool

yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three story addition was placed on a single story building that was previously known as the Colonial Avenue Building which was erected in 1910. This Hall contains on the first floor the Cotton Finishing laboratory with class rooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry and Textile Coloring Department.

CAMPUS AND DORMITORIES

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will be further improved to make a modern campus for baseball and other sports.

At the time of printing of this Bulletin, dormitories are being built which will be available for occupancy sometime late in 1947. Each building is 144 feet long and 41 feet wide with four stories and basement. There will be accommodations for 112 students in each building. Additional information on the dormitories can be obtained by writing the Institute.

GENERAL INFORMATION

Application for Admission. — A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration. — Each freshman is expected to be in daily attendance beginning Wednesday, September 10, at 9.30 a.m., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration. — All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions. — The regular school sessions are in general from 8.30 a.m. to 12.20 p.m., and from 1.30 to 4.00 p.m., except Saturdays, when no classes are held.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance. — Attendance is expected of all students for all classes. In the case of prolonged absence from class, the student will be asked to explain his absence, and a letter will be sent to the parent or guardian announcing that the student is not attending class regularly. It is considered a serious offense to cut classes immediately before or after holiday recesses or vacations. Prolonged, unexplained absences from classes will be considered grounds for dismissal.

Advisers. — Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct. — Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations. — Examinations will be held during the eighth week of each term and final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing. — During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Library and Reading Room. — That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

The Chemistry and Dyeing Department also has a library supplied with books and periodicals which pertain to chemistry in general and textile chemistry and dyeing in particular.

FEES, DEPOSITS, ETC.

Tuition Fee. — The fee for the day course is $150 per year for residents of Massachusetts, and $250 per year for non-residents. The fee for students from foreign countries is $500 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee. — An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Publication Fee. — A publication fee of $7 is due and payable at the first payment of tuition.

Deposits. — Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Board and Rooms. — If space is not available in the dormitories, students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $15 per week and upwards.

Books and Materials. — Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (foreigners)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Publication Fee	7
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop).	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

DEGREE COURSES

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Board or by the Board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

REQUIRED SUBJECTS

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	12

ELECTIVE SUBJECTS

	Points
Elementary French (two years) or–	2
Elementary German (two years) –	
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanics Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1
Equivalent Scientific Subjects	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

DIPLOMA COURSES

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects. These courses are discontinued starting with September 1946.

REQUIRED SUBJECTS

	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	10

ELECTIVE SUBJECTS

Three may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows: —

Thursday, June 5, 1947; Monday, September 8, 1947; Thursday, June 3, 1948: —

Algebra, 9 A.M. to 11 A.M.
History, 11 A.M. to 1 P.M.
English, 2 P.M. to 4 P.M.

Friday, June 6, 1947; Tuesday, September 9, 1947; Friday, June 4, 1948: —

Plane Geometry, 9 A.M. to 11 A.M.
German or French, 11 A.M. to 1 P.M.
Chemistry, 11 A.M. to 1 P.M.
Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

ALGEBRA A1. — Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

ALGEBRA A2. — Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

PLANE GEOMETRY. — The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

CHEMISTRY. — Requirements are those of the New England College Entrance Board, or the Board of Regents of New York, including personal laboratory work. Those not meeting the requirements by school or college certificate will be subject to written examination.

ENGLISH. — As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

HISTORY. — Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an

elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted·

PHYSICS. — The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

MODERN LANGUAGES. — Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

ELEMENTARY GERMAN A. — The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

ELEMENTARY FRENCH A. — The entrance examination is composed of two parts, both taken, however, at the same time.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

HISTORY. — If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

SOLID GEOMETRY. — The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

TRIGONOMETRY. — The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

MECHANICAL DRAWING. — The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

MECHANICS ARTS. — The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

ELEMENTARY FRENCH B. — Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

ELEMENTARY GERMAN B. — Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

ADVANCED FRENCH OR GERMAN. — In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

SPANISH. — Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

LATIN. — Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

DEGREE COURSES. — The four-year degree courses can be summarized as follows:

Textile Engineering.
Chemistry and Textile Coloring.
Textile Manufacturing.

At the completion of these courses the degrees of Bachelor of Science in the various courses are conferred.

There are three options offered in the Engineering Course, viz., textile engineering, general manufacturing, and sales engineering. The first of these emphasizes the mechanical engineering aspects of textile products and processing equipment whereas the second deals with the processing of all textile fibers on all of the conventional equipment. This latter option would enable a graduate to branch into any field of textile processing with some prior knowledge of its procedures. The third option allows a student to specialize in subjects dealing with the selling and marketing of textiles.

Under the heading of textile manufacturing, there are four courses dealing with the manufacture of textile materials. These are planned so that a student may specialize in any one of a number of options, namely, cotton, wool, synthetics, and design.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

DIPLOMA COURSES. — The following discontinued courses terminating in 1948 extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COEDUCATIONAL

Within the last few years the possibilities for women in certain branches of the textile field have become recognized and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some who choose the Textile Engineering Course with the design option, for it offers a broad training that prepares for many lines of activity. For those who wish to specialize in textile designing and art, The Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry and Textile Coloring Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

ADMISSION TO GRADUATE SCHOOL

1. As a Graduate Student

An applicant for admission as a Graduate Student must present evidence that he is the holder of a Bachelor's degree in an acceptable four-year course, in the pursuance of which he maintained a scholastic standing which placed him in the upper two-thirds of his class at graduation. He must also be prepared to submit statements, from persons qualified to judge, that in their opinion he has the ability to pursue graduate work.

Prerequisite for Graduate Work

For admission to graduate work the satisfactory completion of the following undergraduate work is required except under unusual circumstances (see 2 on Provisional status):

Mathematics, one and one half years college mathematics with one year of calculus.

Chemistry, one or more years of college chemistry.

Physics, one or more years of college physics.

Cultural Subjects, equivalent in kind and amount to those given at Lowell Textile Institute in the undergraduate curricula.

Professional Subjects, as specified by the department in which applicant desires to enroll.

2. As a Provisional Graduate Student

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (1) may be accepted provisionally, provided he satisfies the department in which he wishes to enroll that he is probably able to pursue graduate studies successfully.

The status of such a student will be changed to that of a Graduate Student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of 3.5 (80%).

REQUIREMENTS FOR GRADUATION

To be recommended for the Master of Science degree a student must have fulfilled the following requirements:

1. Completed a course of study and research (with thesis), approved by the department in which he has been enrolled, during

2. Residence of at least one academic year, with
3. An average rating of 3.5 (80%) with no failures.

The approved course of study and research shall contain at least 36 term hours of subjects which are of the A classification (graduate level), and of which approximately 18 term hours will be devoted to a thesis.

A graduate of the Lowell Textile Institute, or one with equivalent preparation, can usually complete the work for the Master's degree in one year. Others will require a longer time, usually two years, according to the number of pre-requisite subjects which must be taken.

PHYSICAL EDUCATION AND ATHLETICS

Through competition in athletics and through instruction in classes in physical education the Department of Physical Education attempts to balance the intellectual and mental progress of the students by developing proper health habits, by promoting better physical development, and by inspiring high ideals of sportsmanship.

Physical education and athletics are under the supervision of the Head of the Physical Education Department, who is also Faculty Director of Athletics.

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

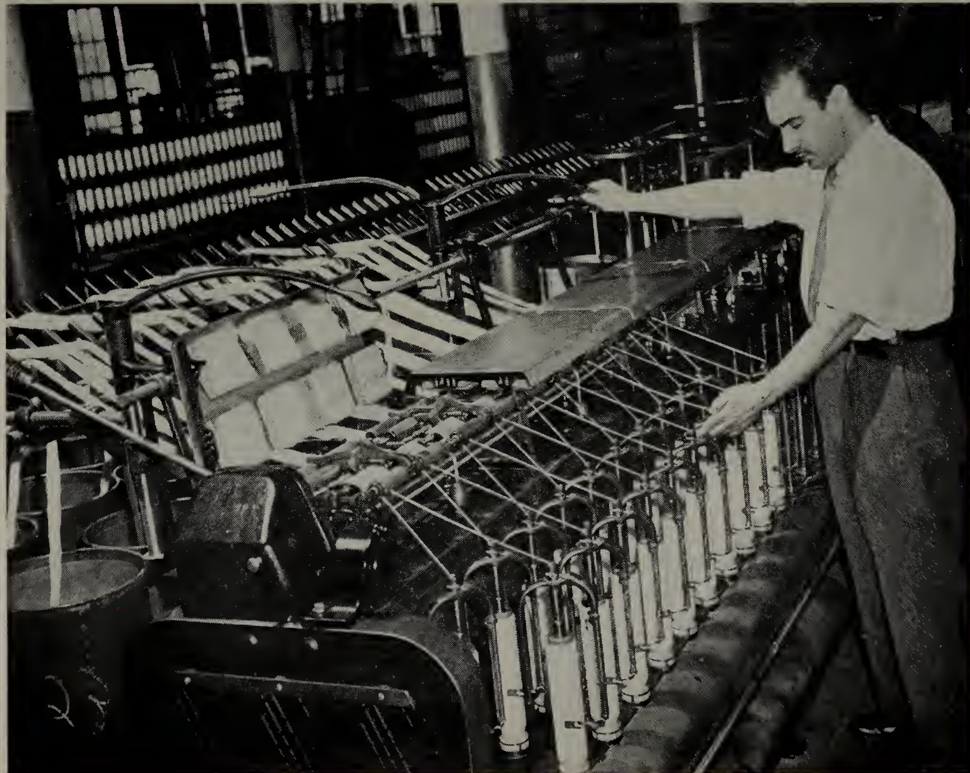
The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

ATHLETIC ASSOCIATION

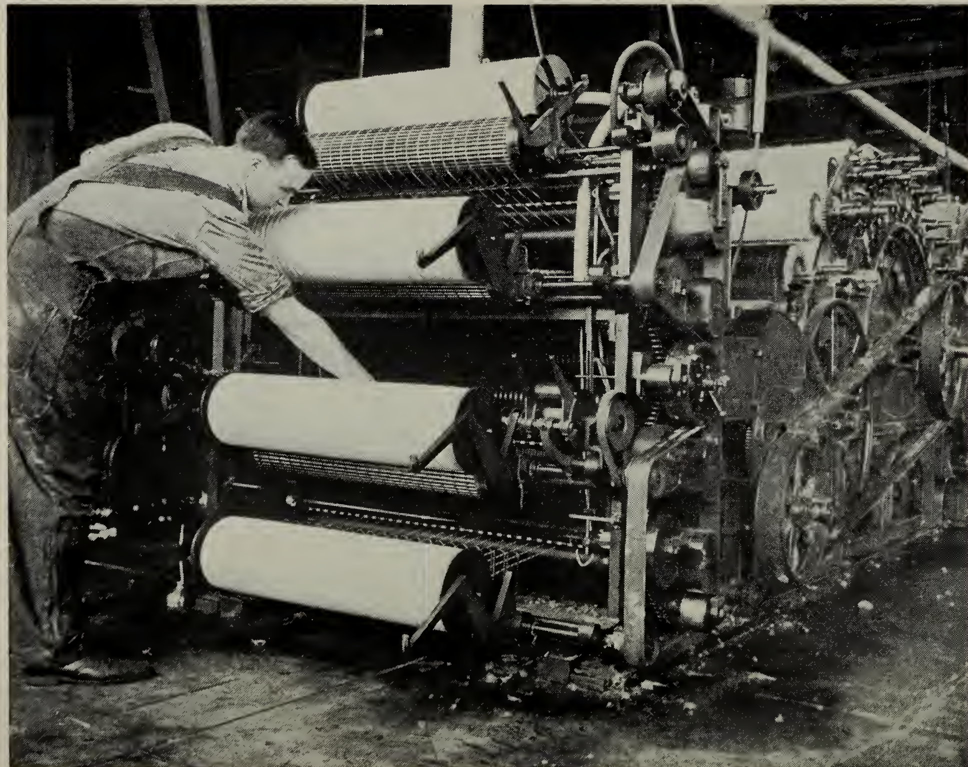
All students, by virtue of payment of the student athletic tax, are members of the Athletic Association and are represented by an executive council of sixteen, consisting of the president and athletic representative from each of the four classes, the captains and managers of the three varsity sports, and one representative each from the Pickout and the Textile Players. This Council acts as an advisory body to the Athletic Director, has charge of social and athletic events run by the Athletic Association, and ratifies the awarding of letters and appointment of student managers in the various sports.

The schedules of all sports are arranged with the interest of both the Institute and the individual members of the teams in mind. Admission to all home contests is included in the athletic fee which is paid by each student at the time of registration.

Teams are regularly maintained in varsity football, basketball, and baseball. Recently Textile has been represented by tennis and golf teams and by a junior varsity basketball team. Intramural competition is provided by interclass and interfraternity competition.



SUPERDRAFT ROVING FRAME



WOOLEN CARD

CURRICULUM

In the column headed "Hours of Exercise" the numbers represent for each particular subject the hours required in school for lecture and laboratory each week.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 41.

The departments are indicated as follows: —

Textile Engineering	B	Cotton and Knitting	F
Chemistry and Textile Coloring	C	Wool and Worsted	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year. First Term. (Common to All Courses)

	Hours of Exercise
Elementary Inorganic Chemistry C–10	4–3
English E–10	3–0
Mathematics B–10	5–0
Engineering Drawing B–13	2–4
Physics B–11	4–1
Physical Education	0–2
Survey of Textiles B–14	2–0

Second Term

	Courses I, II, V	Courses VIE, VIG, VIS	Course III	Course IV
Chemical Technical Methods C–12a	0–3	0–3	–	–
Elementary Inorganic Chemistry C–10	3–0	3–0	3–0	5–0
Elementary Organic Chemistry C–11	3–0	3–0	3–0	3–0
Engineering Drawing B–13 or B–13a	1–4	2–4	–	–
English E-10	3–0	3–0	3–0	3–0
Freehand Drawing D–12	–	–	0–2	–
Handloom Weaving D–11	–	–	1–2	–
Machine Tool Laboratory B–16	1–2	–	–	–
Mathematics B–10	4–0	4–0	4–0	4–0
Mechanism B–12 or 12a	4–0	4–0	2–0	2–0
Perspective D–13	–	–	1–1	–
Physical Education	0–2	0–2	0–2	0–2
Properties of Fibers and Fabrics B–15	–	2–0	–	–
Qualitative Analysis C–12	–	–	–	1–10
Textile Design Weaves, Yarn Calc. D–10	–	–	6–0	–

COTTON MANUFACTURE

The Cotton Manufacturing Course is intended for students contemplating a career in the manufacture of yarns or fabrics of cotton or the new synthetics processed after the methods used for cottons. With eighty per cent of the textile fibers consumed in the United States cotton, it is the policy of this course to give the student a thorough course of instruction in handling cotton first. Later, the adaptation of cotton machinery to handle rayon, wool or other fibers is covered.

By vote of the faculty, the three-year diploma course in Cotton Manufacture, offered for the last 50 years, has been discontinued. The Cotton Option Engineering Course has been discontinued also. The present course in Cotton Manufacture is a four-year course which is more complete than the older course at the completion of which the student will receive the degree of Bachelor of Science.

The subjects for the first year are those common to all courses and they lay a foundation of the sciences of Chemistry, Mathematics and Physics on which the explanations of the principles of manufacturing operations may be based. The sciences continue through the other years of the course, giving additional phases of Mathematics and Physics as background for textile needs.

The arts are represented with freshman and sophomore English, sophomore History and Literature, junior Economics, and senior Sociology and Labor Relations.

Textile instruction begins in the second year and follows through the rest of the course. Instruction regarding the manufacture of cotton yarns is carried through the second and third years as a continuous course using lectures which supplement specially prepared texts for this work, and reference books generally available to the trade. This makes possible covering the new developments as well as the established practices. As the Cotton Manufacturing major spends considerable time in the laboratory, it is possible to do extensive work with actual commercial machines, studying different cottons, classing, processing stock and making various adjustments of machines to test the effect on the quality of the work produced.

Supplementary courses for one term each cover the subjects of Cottons, Cotton Waste Processing, Staple Fiber Manufacture and Quality Control for cotton yarns. These courses provide instruction for the students majoring in Cotton Manufacturing which cannot be included in the more general course.

During the second and third years, the Cotton Manufacturing student spends considerable time in the study of the design, analysis, warp preparation and weaving for cotton and synthetic fabrics. Starting with simple fabrics, the student is carried through lectures and laboratory practice on plain, dobby, box and jacquard looms and their fabrics. For this work, special outlines are used for guiding the student in study and demonstrations. Laboratory practice consists of warp preparation and weaving of actual fabrics on commercial types of looms.

During the third year, courses on Color, Textile Chemistry and Dyeing are intended to give some background to be of use in connection with the production of colored yarns or fabrics.

In this same year, a short survey course on the manufacture of woolen and worsted yarns is offered to broaden the background of the cotton student.

The Finishing of Cotton and Synthetic Fabrics is given in the fourth year. This work is done with lectures on the principles and practices used in finishing these fabrics and laboratory practice using commercial machines and pieces of fabric of standard construction often produced of yarns spun and woven by the students in the Institute laboratories.

In the senior year, the courses on Mill Organization and Management Problems correlate much of the work of Carding, Spinning, Designing and Weaving, covering the planning of organizations for yarns for different fabrics, calculating the machinery to balance and arranging it in the mill.

A course in Knitting taken during the senior year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lectures giving the students knit fabric analysis and actual working knowledge of a wide range of knitting machines and knitted fabrics.

For detailed description of the subjects see p. 41.

COURSE I.—COTTON MANUFACTURE

[For first term see page 23]

Second Year. First Term

Business English E–20	3–0	Physics B–23	3–2
Cotton Carding F–20	3–6	Textile Design Weaves Yarn D–10a	4–0
Cottons F–22	1–1	Weaving D–24a	2–2
Mathematics B–20a	4–0		

Second Year. Second Term

Cotton Carding F–21	3–5	Physics B–23	3–2
Cotton Waste Processing F–23	1–1	Textile Design and Cloth D–26	3–1
Heat and Power B–24	2–2	Weaving D–24a	2–2
History E–23 or Literature E–22	3–0		

Third Year. First Term

Color D–33a	1–1	Staple Fiber Manufacture F–32	1–1
Cotton Spinning F–30	2–5	Survey of Wool Manufacture G–32	2–1
Economics E–30	3–0	Textile Chemistry C–35	2–0
Electronics B–31	3–1	Textile Design & Cloth D–26	3–1
		Weaving D–32a	1–3

Third Year. Second Term

Application of Textile Fabrics	2–0	Survey of Wool Manufacture G–32	2–1
Cotton Winding and Twisting F–31	2–10	Textile Chemistry C–35	1–3
Economics E–30	3–0	Textile Literature B–301	1–1
Quality Control F–33	1–0	Weaving D–32a	2–2

Fourth Year. First Term

Cotton and Rayon Finishing H–41	3–3	Sociology E–40	3–0
Knitting K–40	2–4	Textile Costing B–40	3–0
Management Problems F–41	2–0	Textile Marketing B–42	2–0
Mill Organization F–40	4–0	Textile Microscopy B–41	2–2

Fourth Year. Second Term

Advanced Knitting K–41	3–3	Sociology E–40	3–0
Business Administration B–46	4–0	Textile Marketing B–42	2–0
Cotton and Rayon Finishing H–41	13–3	Textile Testing B–43b	3–3
Labor Relations E–41	3–0		

COURSE 11 WOOL MANUFACTURE

This course on wool manufacture leading to the degree of Bachelor of Science after four years of study is arranged for those students who contemplate a career in industries which utilize wool fiber.

The details of fiber manipulation from the greasy fleece to a finished fabric are well covered in lectures and laboratory exercises which include practical work on modern machinery in the several textile departments.

During the first year a short survey course in general textiles is given to introduce this field and help the initiate to decide in which branch he is most interested. Inorganic and organic chemistry is covered as a basic requirement for later courses necessary in understanding the complex chemical problems in wool scouring, oiling, dyeing and finishing. Mathematics, physics, mechanism, and engineering drawing form a basis for later study of textile machinery.

In the second year types and breeds of sheep are noted with lectures and practice in wool grading, sorting, scouring, and carbonizing. Wool wastes, rags, reworked wool routines, and synthetic staple fibers are included. Scoured worsted wools are processed into top on both the English and French systems. Fundamentals of fabric weaves and design with lectures and demonstration on modern looms further the textile trend.

The third year introduces yarn manufacture on the woolen system, and both the English and French methods for worsted yarns. Advanced cloth design and weaving is available with textile chemistry and dyeing. A survey course covers the fundamentals of cotton yarn manufacturing to aid in understanding modern machine developments for all-fiber manipulation. Electronics is taught to cover modern types of processing controls.

The fourth year offers lectures and laboratory work in knitting and knit designing to cover developments in fabric manufacture on "circular looms." Cloth finishing in lectures and practice completes the routine from sheep to cloth. Textile marketing gives instruction on the latest methods of fabric merchandising. Textile testing, microscopy, and properties of fiber and fabric furnish the fundamental information necessary for analysis and evaluation of fabric quality. Woolen and worsted organization summarizes the textile operations in complete layouts necessary for manufacturing specific yardages of wool cloth. Business administration, sociology, and labor relations courses complete a very thorough training for textile plant operation.

For detailed description of the subjects see page 41.

COURSE II.—WOOL MANUFACTURE

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Business English E–20	3–0	Textile Design D–10a	4–0
Fiber Preparation G–20	1–2	Top Making G–21	2–6
Mathematics B–20a	4–0	Weaving D–24a	2–2
Physics B–23	3–2		

Second Year. Second Term

Fiber Preparation G–20	1–2	Textile Design D–27	3–0
Heat and Power B–24	2–2	Top Making G–21	2–6
History or Literature E–23; E–22	3–0	Weaving D–24a	2–4
Physics B–23	3–2		

Third Year. First Term

Color D–33b	1–1	Textile Design D–27	3–1
Economics E–30	3–0	Weaving D–32a	1–2
Electronics B–31	3–1	Woolen Yarn Mfg. G–30	1–3
Survey Cotton Mfg. F–34	2–1	Worsted Yarn Mfg. G–31	4–2
Textile Chemistry C–35	2–0		

Third Year Second Term

Application of Textile Fabrics	2–0	Textile Literature B–301	1–1
Economics E–30	3–0	Weaving D–32a	1–2
Survey Cotton Mfg. F–34	2–1	Woolen Yarn Mfg. G–30	2–3
Textile Chemistry C–35	1–3	Worsted Yarn Mfg. G–31	4–4

Fourth Year. First Term

Instrumentation B–401	0–3	Textile Marketing B–42	2–0
Knitting K–40	2–7	Textile Microscopy B–41	2–2
Sociology E–40	3–0	Woolen & Worsted Finishing H–40	3–3
Textile Costing B–40	3–0		

Fourth Year Second Term

Business Administration B–46	4–0	Textile Marketing B–42	2–0
Knitting K–41	2–0	Textile Testing B–43b	3–2
Labor Relations E–41	3–0	Woolen Organization G–40	2–0
Sociology E–40	3–0	Woolen & Worsted Fin. H–40	3–3
		Worsted Organization G–41	2–0

COURSE III TEXTILE DESIGN

This course of four years leading to a degree of Bachelor of Science is especially intended to equip students for a career in the field of textile designing and styling. Full opportunity is given for the development of creative ideas with an extensive background of essential technical and practical manufacturing training.

During the first year a short course in general textiles indicates the breadth of the subjects to be covered later. Perspective and freehand drawing start a creative training with textile design and hand loom weaving as the beginning of textile applications.

The second year continues with decorative design, fabric design, cloth analysis, and power weaving. Properties of fiber and fabric outline the tremendous opportunities for the designer in using modern synthetic fibers with the natural fibers to build fabrics of outstanding characteristics.

The third year develops with a study of color as a necessity for eye appeal in textiles. Textile dyeing covers the methods used in providing this color. Design, cloth analysis and power weaving advance with a survey course in both cotton and wool yarn manufacturing to acquaint the student with methods used in making manipulated yarns on these systems. Textile marketing instructs in merchandising methods.

In the fourth year textiles move on to Jacquard design and weaving, and lectures and laboratory work in knitting. Textile microscopy further aids in the training of fiber study. Cloth finishing completes the textile subjects except for testing as a means for yarn and fabric evaluation. Cultural subjects essential in modern business are covered to complete a comprehensive field of study in Course III.

For detailed descriptions of subjects see page 41.

COURSE III.—TEXTILE DESIGN

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Business English E–20	3–0	Textile Des. & Cloth D–20	3–1
Decorative Design D–22	2–2	Textile Des. & Cloth D–21	3–1
Mathematics B–20a	4–0	Weaving D–24	2–4
Physics B–23	3–2		

Second Year. Second Term

Decorative Design D–22	1–1	Prop. of Fiber & Fabric B–15	2–0
History or Literature E–23; E–22	3–0	Textile Des. & Cloth D–20	4–2
Physics B–23	3–2	Textile Des. & Cloth D–21	4–2
		Weaving D–24	2–4

Third Year. First Term

Color D–33	1–4	Textile Marketing B–42	2–0
Economics E–30	3–0	Weaving D–32	2–4
Textile Chemistry C–35	2–0	Survey—Cotton Mfg. F–34	2–1
Textile Des. & Cloth D–30	3–1	Survey—Wool Mfg. G–32	2–1
Textile Des. & Cloth D–31	3–1		

Third Year. Second Term

Application of Tex. Fabrics	2–0	Textile Literature B–301	1–1
Economics E–30	3–0	Textile Marketing B–42	2–0
Textile Des. & Cloth D–30	2–0	Survey—Cotton Mfg. F–34	2–1
Textile Des. & Cloth D–31	3–1	Survey—Wool Mfg. G–32	2–1
Textile Chemistry C–35	1–3	Weaving D–32	2–4

Fourth Year. First Term

Cotton & Rayon Finishing H–41	3–3	Textile Costing B–40	3–0
Jacquard Design D–42	1–4	Textile Des. & Cloth D–41	2–0
Knitting K–40	2–5	Textile Microscopy B–41	2–2
Sociology E–40	3–0		

Fourth Year. Second Term

Business Administration B–46	4–0	Sociology E–40	3–0
Jacquard Design D–42	1–3	Textile Des. & Cloth D–40	2–0
Knitting K–41	2–0	Textile Testing B–43b	3–2
Labor Relations E–41	3–0	W & W Finishing H–40	3–3

COURSE IV. CHEMISTRY AND TEXTILE COLORING

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.S., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Properties of fibers and fabrics, textile chemistry and quantitative analysis are studied the second year.

Courses in textile literature, advanced organic, technical methods of analysis, physical chemistry and textile chemistry including dyeing and finishing of fabrics are given the third year.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. Much time is spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in colloid chemistry microscopy, textile testing, and chemical engineering, as applied to textiles, color matching, textile printing, and dyeing.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 41.

COURSE IV.—CHEMISTRY AND TEXTILE COLORING

[For first term see page 23]

Second Year. First Term. (Hours of Exercise)

Business English E–20	3–0	Properties of Fibers C–20	2–0
Elementary German E–11	3–0	Textile Design D–10b	2–0
Mathematics B–20a	4–0	Textile Chemistry C–21	1–4
Physics B–23	3–2	Quantitative Analysis C–22	2–4
Properties of Fabrics D–23	1–0		

Second Year. Second Term

Advanced German E–21	3–0	Textile Chemistry C–21	1–4
Mathematics C–23	2–0	Textile Manufacture	0–2
Physics B–23	3–2	Quantitative Analysis C–22	2–9
Textile Design D–10a	2–0		

Third Year. First Term

Dyeing C–31	1–6	Physical Chemistry C–33	3–0
Economics E–30	3–0	Quantitative Analysis C–30	1–9
Organic Chemistry C–32	2–3	Textile Manufacture	0–2

Third Year. Second Term

Application of Text. Fabrics	2–0	Physical Chemistry C–33	2–3
Dyeing C–31	1–4	Quantitative Analysis C–30	1–6
Economics E–30	3–0	Textile Literature C–34	1–1
Organic Chemistry C–32	2–3		

Fourth Year. First Term

Chemical Engineering C–45	2–0	Sociology E–40	3–0
Colloid Chemistry C–43	3–0	Textile Microscopy C–42	1–3
Dyeing C–44	1–6	Textile Testing C–40	2–3
Organic Chemistry C–41	0–6		

Fourth Year. Second Term

Colloid Chemistry C–43	0–3	Textile Testing C–40	2–3
Dyeing C–44	1–6	Electives or Thesis	4–8
Sociology E–40	3–0		

COURSE V. SYNTHETIC TEXTILES

The course in synthetic textiles is intended for those students who wish to major in the study of synthetic fibers and their manufacture. While much of the content of the course has been given over the past years, this particular arrangement of subjects specializes on rayons, nylons, Aralac and other man-made fibers. The curriculum is laid out to require four years and, upon successful completion of the work, a student will receive the degree of Bachelor of Science (B.S.)

Owing to the fluidity of developments of synthetic fibers, it is expected that some changes will be necessary from time to time to keep subjects properly balanced.

Freshman subjects are those common to other courses majoring in yarn and fabric manufacturing and are intended as a broad foundation for later work.

During the sophomore year the student begins to specialize in courses covering the various synthetic fibers, their preparation for spinning, and the production of woven fabrics. Owing to the chemical nature of synthetic fibers, considerable emphasis is placed on the study of organic chemistry which is taken at the same time that the student is given instruction in dyes and their application. Courses in mathematics and physics provide scientific background for later technical work.

In the junior year, the textile subjects cover spinning, winding, twisting, weaving, and fabric finishing, with a continuation of engineering work, such as electrical and heat engineering. Economics is given during this year to be followed by Marketing in the senior year.

In the senior year, further fabric finishing, mill organization, knitting, textile testing, and microscopy complete the textile subjects. Accounting and business administration courses give the student some fundamental ideas in these fields, while electrical and mill engineering add to the work of the previous years.

For detailed description of the subjects see page 41.

COURSE V.—SYNTHETIC TEXTILES

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Business English E–20	3–0	Textile Design D–10a	4–0
Fiber Properties C–24	3–0	Filament Processing	3–3
Mathematics B–20a	4–0	Weaving D–24	2–2
Physics B–23	3–2		

Second Year. Second Term

Fiber Properties C–24	3–0	Textile Design D–26	4–0
Heat and Power B–24	2–2	Filament Processing	3–3
History or Literature E–22, E–23	3–0	Weaving D–24	2–4
Physics B–23	3–2		

Third Year. First Term

Color D-33W	1–1	Textile Chemistry C–37	2–0
Economics E–30	3–0	Textile Design D–34	3–1
Electronics B–31	3–1	Filament Processing	3–3
Survey Cotton Mfg. F–35	2–1	Weaving D–34	1–2
Survey Wool Mfg. G–32	2–1		

Third Year. Second Term

Applications of Tex. Fabrics	2–0	Textile Literature B–301	1–1
Economics E–30	3–0	Filament Processing	3–6
Survey Cotton Mfg. F–35	2–1	Weaving D–34	1–2
Survey Wool Mfg. G–32	2–1		
Textile Dyeing C–35	1–3		

Fourth Year. First Term

Textile Instrumentation B–49	0–3	Textile Marketing B–42	2–0
Knitting K–40	2–7	Textile Microscopy B–41	2–2
Sociology E–40	3–0	Cotton & Rayon Finishing H–41	3–3
Textile Costing B–40	3–0		

Fourth Year. Second Term

Business Admin. B–46	4–0	Textile Marketing B–42	2–0
Knitting K–41	2–0	Textile Testing B–43b	3–2
Labor Relations E–41	3–0	Cotton & Rayon Finishing H–41	3–3
Sociology E–40	3–0	Synthetics Summary	4–0

COURSE VI. TEXTILE ENGINEERING

The course in Textile Engineering is a four-year course leading to the degree of Bachelor of Science in Textile Engineering (B.S.) for all three of its options; General Manufacturing, Engineering, and Sales. Each of the three options study all the commonly used textile fibers, cotton, wool, and synthetics.

General Manufacturing (G)

The General Manufacturing Option is designed for the man who wishes a thorough preparation in the manufacturing and processing of all textile fibers. This practical textile training is combined with a background in basic engineering subjects to fit the student to meet the demand of the textile and allied industries for men with a combined textile and technical preparation.

About one-half of the students' time beyond the basic freshman year is devoted to the design and manufacture of textiles, while courses in mathematics, physics, electricity, heat, strength of materials, machine tool laboratory, etc., give him the basic grasp of engineering fundamentals necessary for all mechanical engineering.

A large part of the time devoted to textile manufacturing is spent in the well-equipped laboratories of the various textile departments where the student gains a practical and first-hand knowledge of manufacturing finished textile fabrics from cotton, wool, rayon, nylon, and other textile fibers.

Engineering (E)

This option is designed to give the student a thorough preparation in the fundamental principles of mechanical engineering with specialization on the engineering problems arising out of textile manufacturing in all its branches. It emphasizes basic engineering rather than the details of textile processing and should equip the student with the necessary background to enter any branch of the textile or allied industries in an engineering capacity.

The student receives, however, an adequate background of fiber preparation, yarn manufacture, design, weaving and finishing of all the major textile fibers. This textile background is combined with the students' mechanical engineering training in a series of subjects in the third and fourth years which treat of fiber, yarn and fabric from the standpoint of an engineering material, applying scientific principles to the development and testing of fabrics of all types.

Due to the rather heavy academic load carried by this option, it is recommended only for the better-than-average student.

Sales (S)

This option is designed for the man interested in the distribution end of the textile industry. A background of the textile manufacturing processes is included with particular emphasis on design, testing and development of fabrics. The basic courses needed for an understanding of engineering principles are also included but major emphasis is on the complex problems involved in marketing all types of textile products.

Considerable time in the senior year is allowed for electives so that the student may acquire greater technical knowledge in those branches of the industry of greatest interest to him.

COURSE VI-E.—TEXTILE ENGINEERING (Engineering Option)

[For first year see page 23]

Second Year. First Term (Hours of Exercise)

Business English E–20	3–0	Textile Design D–10a	4–0
Machine Drawing B–21	1–2	Textile Mechanism B–26	1–2
Machine Tool Laboratory B–33	0–3	Weaving D–24b	2–0
Mathematics B–20	4–0	Wool Survey G–32	2–1
Physics B–23	3–2		

Second Year. Second Term

Applied Mechanics B–25	3–0	Physics B–23	3–2
History or Literature E–23 or E–22	3–0	Textile Design D–26a, D–27a	4–2
Machine Tool Laboratory B–33	0–3	Weaving D–24b	2–0
Mathematics B–20	4–0	Wool Survey G–32	2–1

Third Year. First Term

Applied Mechanics B–30	3–0	Statistics B–37	2–0
Cotton Survey F–34	2–1	Textile Chemicals C–21a	2–0
Economics E–30	3–0	Textile Testing B–43	3–2
Electronics B–31	3–2	Weaving D–32b	2–0
Knitting K–40a	2–3		

Third Year. Second Term

Applied Mechanics B–30	3–0	Engineering Materials B–39	2–0
Cotton Survey F–34	2–1	Heat Engineering B–32	3–2
Economics E–30	3–0	Textile Physics B–302	3–3
Electrical Engineering B–38	3–2	Weaving D–32b	2–0

Fourth Year. First Term

Cotton and Rayon Finishing H–41	3–3	Textile Costing B–40	3–0
Electrical Engineering B–44	3–2	Textile Microscopy B–41	2–4
Heat Engineering B–47	2–2		
Marketing B–42	2–0		
Sociology E–40	3–0		

Fourth Year. Second Term

Application of Textile Fabrics	2–0	Textile Instrumentation B–401	2–0
Business Administration B–46	4–0	Textile Research B–402	2–0
Fabric Development B–48	2–0	Textile Microscopy B–41a	(1–2)
Machine Design B–49	2–2	or	
Sociology E–40	3–0	Textile Applications of Electricity B–45	(2–1)
		Woolen and Worsted Finishing H–40	3–3

COURSE VI-G.—TEXTILE ENGINEERING (General Manufacturing)

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Business English E–20	3–0
Mathematics B–20	4–0
Physics B–23	3–2
Textile Chemicals C–21a	2–0
Textile Design D–10a	4–0
Weaving D–24b	2–0
Yarn Manufacturing:	
Cotton System F–20a	3–2
Woolen and Worsted Systems G–20, G–21	3–2

Second Year. Second Term

History E–23 or Literature E–22	3–0
Mathematics B–20	4–0
Physics B–23	3–2
Textile Design D–26a, D–27a	4–2
Weaving D–24b	2–0
Yarn Manufacturing:	
Cotton System F–21a	3–2
Woolen and Worsted Systems G–20, G–21	3–2

Third Year. First Term

Economics E–30	3–0
Machine Tool Laboratory B–33	0–3
Mill Engineering B–34	3–0
Electronics B–31	3–1
Strength of Materials B–303	3–0
Weaving D–32b	2–0
Yarn Manufacturing:	
Cotton System F–30a	2–3
Woolen System G–30	1–1
Worsted System G–31	4–1

Third Year. Second Term

Economics E–30	3–0
Electrical Engineering B–38	3–1
Heat Engineering B–32	3–1
Machine Tool Laboratory B–33	0–3
Weaving D–32b	2–0
Textile Literature B–301	1–1
Yarn Manufacturing:	
Cotton System F–31a	2–3
Woolen System G–30	2–1
Worsted System G–31	4–1

Fourth Year. First Term

Cotton and Rayon Finishing H–41	3–3
Electrical Engineering B–44 or Heat Engineering B–47	2–2
Mill Organization F–40	4–0
Sociology E–40	3–0
Textile Costing B–40	3–0
Textile Marketing B–42	2–0
Textile Microscopy B–41	2–2
Textile Testing B–43	3–2

Fourth Year. Second Term

Applications of Textile Fabrics	2–0
Business Administration B–46	4–0
Textile Instrumentation B–401 or Textile Applications of Electricity B–45	2–0
Knitting K–40a	2–3
Woolen and Worsted Organization G–40, G–41	4–0
Sociology E–40	3–0
Textile Microscopy B–41a or Textile Testing B–43a	0–2
Woolen and Worsted Finishing H–40	3–3

COURSE VI-S.—TEXTILE ENGINEERING (Sales)

[For first year see page 23]

Second Year. First Term. (Hours of Exercise)

Business English E–20	3–0	Physics B–23	3–2
Color D–33	1–4	Textile Chemicals C–21a	2–0
Mathematics B–20	4–0	Textile Design D–10a	4–0
Machine Tool Laboratory B–16	0–3	Weaving D–24b	2–2

Second Year. Second Term

Heat and Power B–24	2–2	Physics B–23	3–2
History E–23 or Literature E–22	3–0	Textile Design and Cloth Construction D–26	3–1
Knitting K–40a	2–3	Weaving D–24b	2–0
Mathematics B–20	4–0		

Third Year. First Term

Economics E–30	3–0	Textile Design and Cloth Construction D–26	3–1
Principles of Marketing B–35	5–0	Survey—Wool Mfg. G–32	2–1
Statistics B–37	2–0	Survey—Cotton Mfg. F–34	2–1
Strength of Materials B–303	3–0	Weaving D–32b	2–0
Textile Testing B–43	3–2		

Third Year. Second Term

Economics E–30	3–0	Textile Design and Cloth Construction D–27	3–0
Marketing Methods B–36	5–0	Textile Physics B–302	3–3
Selling and Advertising B–304	5–0	Weaving D–32b	2–0
Survey—Cotton Mfg. F–34	2–1		
Survey—Wool Mfg. G–32	2–1		

Fourth Year. First Term

Cotton and Rayon Finishing H–41	3–3	Textile Costing B–40	3–0
Foreign Trade B–403	3–0	Textile Design and Cloth Construction D–27	3–1
Selling Policies B–404	4–0	Textile Microscopy B–41	2–4
Sociology E–40	3–0		

Fourth Year. Second Term

Application of Textile Fabrics	2–0	Selling Policies B–404	4–0
Business Administration B–46	4–0	Sociology E–40	3–0
Fabric Development B–48	2–0	Woolen & Worsted Finishing H–40	3–3
Jacquard Design D–42a	1–2	Electives	7
Textile Research B–402	2–0		

DISCONTINUED—COTTON MANUFACTURE

[For first term see page 23]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	45
Elementary Organic Chemistry C–11	30
English E–10	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–12a	45
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Chemical Technology of Fibers C–20	20
Color D–23c	15
Cotton Carding F-20	210
Cotton F–22	15
Physics B–23a	45
Power Weaving D–24	75
Steam Engineering B–24	45
Textile Chemistry and Dyeing Lect. C–21	10
Textile Design and Cloth Construction D–20	90

Second Year. Second Term

Cotton Carding F–21	195
Cotton Waste Processing F–23	30
Physics B–23a	45
Power Weaving D–24	135
Textile Chemistry and Dyeing Lect. C–21	30
Textile Design and Cloth Construction D–20	90

Third Year. First Term

Cotton Finishing H–41	75
Cotton Quality Control F–33	15
Cotton Spinning F–30	135
Electricity B–31a	30
Mill Engineering B–34a	30
Mill Organization F–40	60
Power Weaving D–32	165
Staple Fiber Manufacture F-32	15
Textile Testing B–43b	30
Thesis	

Third Year. Second Term

Cotton Finishing H-41	75
Cotton Winding and Twisting F–31	225
Knitting K-40	105
Power Weaving D-32	120
Thesis	

DISCONTINUED—WOOL MANUFACTURE

[For first term see page 23]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	45	Mathematics B–10	60
Elementary Organic Chemistry C–11	30	Mechanism B–12	60
English E–10	45	Physical Education	30
Machine Drawing B–13	135	Qualitative Analysis C–12a	45
		Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Chemical Technology of Fibers C–20	20	Steam Engineering B–24	45
Fiber Preparation G–20	105	Textile Chemistry and Dyeing Lect. C–21	10
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	90	Top Making G–21	135

Second Year. Second Term

Color D–23w	15	Textile Chemistry and Dyeing Lect. C–21	30
Fiber Preparation G–20	120	Textile Design and Cloth Construction D–21	75
Physics B–23a	45	Top Making G–21	120
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a	30	Woolen and Worsted Finishing H–40	75
Mill Engineering B–34a	30	Woolen Yarn Manufacture G–30	105
Power Weaving D–32a	105	Worsted Yarn Manufacture G–31	180
Textile Testing B–43b	30		

Third Year. Second Term

Knitting K–40	105	Woolen Yarn Manufacture G–30	105
Power Weaving D–32a	135	Worsted Yarn Manufacture G–31	105
Woolen and Worsted Finishing H–40	75	Thesis	

DISCONTINUED—TEXTILE DESIGN

[For first term see page 23]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	45
Elementary Organic Chemistry C–11	30
English E–10	45
Hand Loom Weaving D–11	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education (boys) Women in Industry (girls)	30
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Chemical Technology of Fibers C–20	20
Color D–23	30
Drawing D–27	30
Microscopy B–41	60
Perspective D–26	30
Physics B–23a	45
Power Weaving D–24	135
Textile Chemistry and Dyeing Lecture C–21	10
Textile Design and Cloth Construction D–20, 21	165

Second Year. Second Term

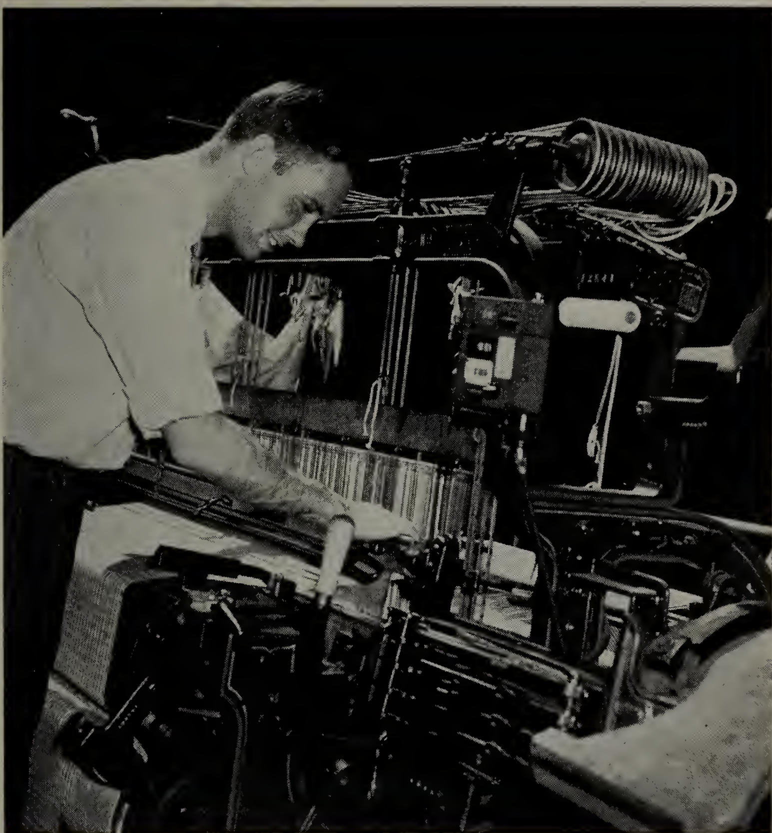
Color D–23	45
Drawing D–27	45
Fiber and Yarn Identification D–28	45
Knitting FK–30a	30
Physics B–23a	45
Power Weaving D–24	135
Principles of Design D–29	45
Textile Chemistry and Dyeing Lect. C–21	30
Textile Design and Cloth Construction D–20, 21	105

Third Year. First Term

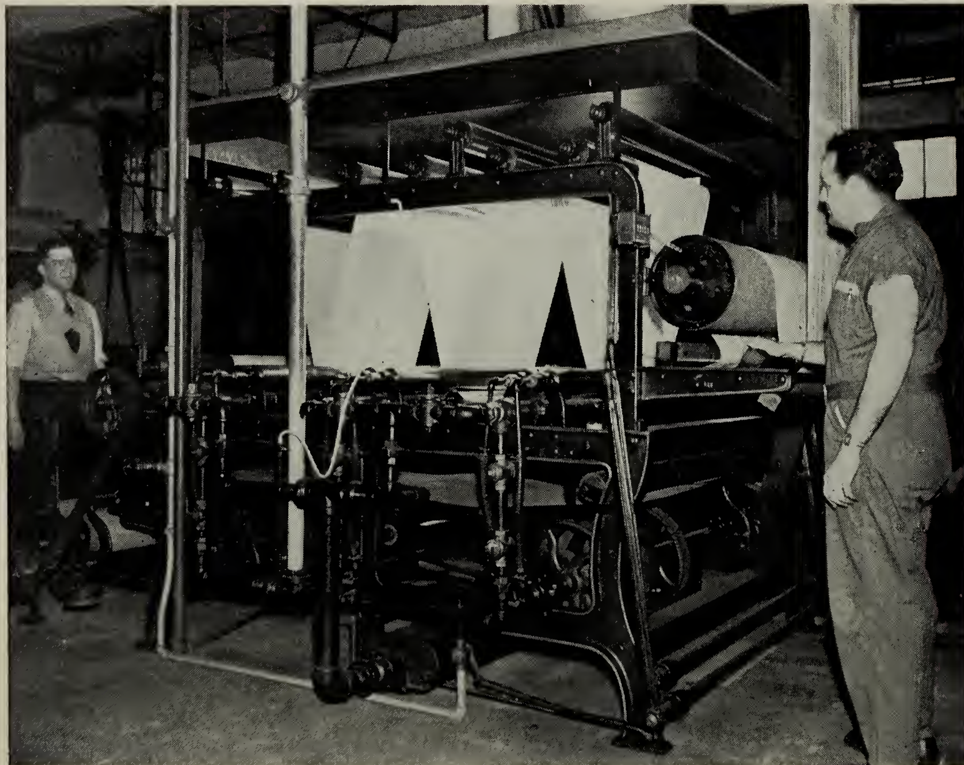
Cotton Finishing H–41	75
Power Weaving D–32	75
Textile Design and Cloth Construction D–30, 31	135
Textile Design and Cloth Construction D–40, 41	75
Textile Marketing B–42	30
Textile Styling D–35	30
Textile Testing B–43a	30
Woolen and Worsted Finishing H–40	75

Third Year. Second Term

Cotton Finishing H–41	75
Jacquard Design and Weaving D–34	90
Power Weaving D–32	120
Textile Design and Cloth Construction D–30, 31	75
Textile Design and Cloth Construction D–40, 41	90



ONE OF THE SIXTY LOOMS



FINISHING A FABRIC

SUBJECT DESCRIPTION

TEXTILE ENGINEERING—B

The various options are designated by
E for Engineering, G for General Manufacturing, S for Sales

MATHEMATICS—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications. [All courses.]

PHYSICS—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

MECHANISM—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [Courses I, II, V, VI.]

MECHANISM—B-12a. Preparation: B-10 and B-11. This subject is an abbreviation of B-12. [Courses III, IV.]

ENGINEERING DRAWING—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, V, VI.]

ENGINEERING DRAWING)B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

SURVEY OF TEXTILES—B-14. This subject is designed to give the student elementary knowledge of the textile industry so that he can choose his future course more intelligently, and so that he can better understand the relations between the various branches of the industry. [All courses.]

PROPERTIES OF FABRICS AND FIBERS—B-15. This subject deals with all of the important fibers, both natural and synthetic, used in the textile industry. It describes their origin, structure, and elementary physical and chemical properties. The names and description of yarns and fabrics now commercially available are also discussed and the reason for their uses for specific purposes. [Courses VI E, G, S.]

MACHINE TOOL LABORATORY—B-16. Preparation: B-11, B-12. The content of B-33 compressed into one term. [Courses I, II, VI-S.]

MATHEMATICS—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—exponential functions, the circle, parabola, ellipse, hyperbola, polar coordinates, indefinite integrals, summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, nomographic charts, and spherical trigonometry and applications. The elements of statistics will be included for Course VI G. [Course VI.]

MATHEMATICS—B-20a. Preparation: B-10. This subject is a one-term continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, trigonometric functions. [Courses I, II, III, IV, V.]

MACHINE DRAWING—B-21. Preparation: B-12, B-13. This is a continuation of B-13 and leads to the making of assembly drawings of textile machines. [Course VI-E.]

PHYSICS—B-23. Preparation: B-10 and B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis, electronics.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. (All Courses)

HEAT AND POWER—B-24. Preparation: B-11, B-23. This subject is a more elementary and briefer treatment of B-32 and B-47. [Courses I, II, V, VI-S.]

APPLIED MECHANICS—B-25. Preparation: B-11, B-20. This subject covers the fundamentals of statics and kinetics, including such topics as force systems, laws of equilibrium, centers of gravity, moments of inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies. [Course VI-E.]

TEXTILE MECHANISM—B-26. Preparation: B-12 and B-13. This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself. [Course VI-E.]

APPLIED MECHANICS—B-30. Preparation: B-25. This subject covers the general topic of strength of materials; including such topics as simple stresses, strain, bending moments, shearing force, slopes and deflections in beams, beam design, torsion, design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, and stress analysis by strain gage methods. [Course VI-E.]

PHYSICS (ELECTRONICS)—B-31. Preparation: B-23. This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. It includes elements of vacuum- and gaseous-tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation. [Courses I, II, VI E, G.]

HEAT ENGINEERING—B-32. Preparation: B-12, B-20, B-23. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks; gauges, inductors and counters; barrel, separating and throttling carolimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI.]

MACHINE TOOL LABORATORY—B-33. Preparation: B-11, B-12. Systematic instruction is given in the most approved methods of machine shop practice to familiarize the student with the proper use of hand and machine tools. Actual work is given in the operations of filing, laying out, straight and taper turn-

ing, thread cutting, drilling, boring, planing, shaping, grinding, milling including gear cutting. Special attention is given to the form, setting, grinding and tempering of tools, and the mechanism of the different machines. Lectures and demonstrations cover such topics as the characteristics of metals, foundry practice, forging, piping, welding, soldering, and die casting. A list of the tools in the Laboratory will be found in the "Equipment" section of this Bulletin. [Course VI E, G.]

MILL ENGINEERING—B-34. PREPARATION: B-303. This course consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construction from a study of actual blueprints; calculation of allowable floor loads; stresses in beams and columns; and machinery layout. [Course VI G.]

PRINCIPLES OF MARKETING—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, S.]

MARKETING METHODS—B-36. PREPARATION: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, S.]

STATISTICS—B-37. PREPARATION: B-20. A short course in statistical methods covering such fundamental concepts as frequency distribution, measures of central tendency, measures of dispersion, normal curve of error and its interpretation, standard error of mean. [Courses VI E, S.]

ELECTRICAL ENGINEERING—B-38. PREPARATION: B-23, B-31. At the beginning of this subject electronic circuits are considered, but the greater part of the term is devoted to direct current generators and motors with a study of their construction and characteristics. Some time is devoted to electrical measurements. Laboratory work is provided to illustrate the principles involved. [Courses VI E, G.]

ENGINEERING MATERIALS—B-39. PREPARATION: B-23. This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treatment; also the properties and uses of non-metallic engineering materials such as timber, cement, concrete, rubber, plastics, and mechanical fabrics. [Course VI G.]

TEXTILE LITERATURE—B-301. This is a subject to introduce the student to the past and current sources of information on textile topics and will include the assignment of topics for written reports. [Course I, II, III, V, VI G.]

TEXTILE PHYSICS—B-302. PREPARATION: B-23. This subject deals with methods for measuring physical properties of textile fibers, yarns, and fabrics. Apparatus is available for making load-elongation tests of fibers and yarns, thermal conductivity of fabrics, color and brightness measurements, and electrical properties of textile materials. [Courses VI E, S.]

STRENGTH OF MATERIALS—B-303. PREPARATION: B-11, B-20a. A more elementary and condensed treatment of B-30. [Courses VI G, S.]

PRINCIPLES OF SELLING AND ADVERTISING—B-304. PREPARATION: B-36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, S.]

TEXTILE COSTING—B-40. PREPARATION: B-10, E-30. Preparation for this subject also requires the completion of a course in double-entry bookkeeping equivalent to that offered by the University Extension of the Massachusetts Department of Education under the title of Elementary Accounting, Parts 1 and 2. This should be taken during the summer prior to the senior year.

This subject is planned to give a knowledge of modern methods of cost accounting with emphasis upon their application to textile manufacturing processes. It includes discussion of methods of handling and accounting for raw materials, direct labor, overhead and its distribution, normal costs and their predetermination, budgeting, cost reports and their use for control purposes. [Courses I, II, III, V, VI.]

TEXTILE MICROSCOPY—B-41. PREPARATION: B-23. This subject consists of the study of animal synthetics and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Courses I, II, III, V, VI.]

TEXTILE MICROSCOPY—B-41a. PREPARATION: B-23, B-41. A continuation of B-41 into a second term and composed of thirty hours of laboratory work. [Course VI G.]

TEXTILE MARKETING—B-42. PREPARATION: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses I, II, III, VI E, G.]

TEXTILE TESTING—B-43. PREPARATION: B-23, B-37, B-303, F-30, G-30, D-10a. This subject is planned to acquaint the student with the latest methods and devices for determining the properties and characteristics of textile fibers, yarns and fabrics. The presentation is based on a knowledge of the basic relations given in a Strength of Materials course, and the laboratory work requires the use of statistical methods. Within the limits of available time, the topics for discussion are taken from the following list: abrasion and wear, absorptability, atmospheric conditions, bursting resistance, color fastness, crimp, elongation, "hand" of fabrics, heat transmission, mildew proofness, moth proofness, permeability to gases and liquids, regain resilience, shrinkage, stiffness and draping quality, strength, tear resistance, thickness, twist, water repellancy, etc. The engineering and statistical approach is used in the discussions, and testing is treated both from the standpoint of commercial testing and of textile research. [Course VI.]

TEXTILE TESTING—B-43a. PREPARATION: B-43. A continuation of B-43 into a second term and consisting chiefly of laboratory work. [Course VI-G.]

TEXTILE TESTING—B-43b. PREPARATION: B-23, F-30, or G-30 and 31, D-30. Similar to the content of B-43 but without the engineering and statistical approach. [Courses I, II, III, V.]

ELECTRICAL ENGINEERING—B-44. PREPARATION: B-31. During the first term polyphase circuits and alternating current machinery are studied. This includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for this motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all of the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Courses VI E, G.]

TEXTILE APPLICATIONS OF ELECTRICITY—B-45. PREPARATION: B-23, B-31, B-44. This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. The work is covered by lectures and laboratory exercises with several trips made to local mills to see the equipment in actual operation. [Courses VI E, G.]

BUSINESS ADMINISTRATION—B-46. PREPARATION: B-10 AND E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

BUSINESS LAW. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy.

LABOR RELATIONS. This subject is given the emphasis which its present-day importance requires. [Courses I, II, III, V, VI.]

HEAT ENGINEERING—B-47. PREPARATION: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the value gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI E, G.]

FABRIC DEVELOPMENT—B-48. Preparation: B-20, B-23, B-303. This subject correlates the engineering properties of textile materials with engineering principles and textile processing to produce fabrics with desired properties. The principles of structure of mechanical fabrics and those in the consumer goods classification are considered. [Courses VI E, S.]

MACHINE DESIGN—B-49. Preparation: B-26, B-30, B-33. Dealing first with the design of fundamental machine elements, the work leads to the design of critical parts of some textile machines. [Course VI-E.]

TEXTILE INSTRUMENTATION—B-401. Preparation: B-20, B-31, B-32. This is a lecture course given during the senior year to acquaint the student with the latest methods of controlling textile process variables such as temperature, pressure, liquid level, and fluid flow.

The first half of the course consists of a study of the entire control unit and includes primary measuring elements, controller mechanisms (pneumatic and electric), and final control elements such as valves, motor levers, etc. Proper selection and application are taken up in detail.

During the second half, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, finishing, etc., are studied from data obtained from actual mill installations. [Courses II, V, VI E, G.]

TEXTILE RESEARCH—B-402. Preparation: B-30, B-41, B-43. A seminar course to familiarize the student with the methods employed in textile research, with the latest developments in this field, and in the use of textile literature. [Course VI E.]

FOREIGN TRADE AND ECONOMIC GEOGRAPHY—B-403. Preparation: E-30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI S.]

SELLING POLICIES—B-404. Preparation: B-36. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, S.]

CHEMISTRY AND DYEING—C

ELEMENTARY INORGANIC CHEMISTRY—C-10. Preparation: Admission Requirements. During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, two lectures and one recitation per week are devoted to the metals and their compounds. [All courses.]

Course IV. Students study qualitative analysis (C-12) and devote 2 hours per week to chemical calculations.

Course I, II, III and VI. Students devote one hour a week to the experiments listed in C-12a.

ELEMENTARY ORGANIC CHEMISTRY—C-11. PREPARATION: ADMISSION REQUIREMENTS. This course, covered by lectures during the second term, includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C-21. [All courses.]

QUALITATIVE ANALYSIS—C-12. PREPARATION: C-10, TAKEN SIMULTANEOUSLY. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. One hour lecture and ten hours of laboratory work are required during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C-10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as mordanted cloths, pigments and the various dyeing reagents.

SEMI-MICRO QUALITATIVE ANALYSIS.—Qualitative analysis for the more common elements by micro methods, with centrifuge, spot tests, etc. [Course IV.]

CHEMICAL TECHNICAL METHODS—C-12a. PREPARATION: C-10 TAKEN SIMULTANEOUSLY. Experiments are based on commercial tests and laboratory procedures in order that the student may more accurately evaluate data furnished by the chemist to the engineer or textile manufacturer. [Courses I, II, VI.]

PROPERTIES OF FIBERS—C-20. PREPARATION: C-10, C-11. This course consists of a series of lectures on the origin, composition and processing of the natural fibers; also the manufacture and properties of the artificial fibers. The chemical and physical properties of the fibers which influence their suitability for textile uses are emphasized. The following outline suggests the scope of the course:

Classification of fibers by origin, by importance, and by chemical composition; properties necessary in a successful textile fiber; chemistry of cellulose, cotton, flax, ramie, jute, hemp, kapok; chemistry of proteins, silk, tussah, wool, reclaimed wool, mohair, other hairs; asbestos; manufactured fibers—history, production of filament and staple fiber, methods of delustering, manufacture of high tenacity yarns, details of manufacture of acetate, cupra, viscose, casein, vinyl, and nylon fibers, comparison of the manufactured fibers with each other and with comparable natural fibers. [Course IV.]

TEXTILE CHEMISTRY AND DYEING—C-21. PREPARATION: C-10, C-11, B-12, B-13a. The outline of the lecture course which is given during the second year is as follows:—

OPERATIONS PRELIMINARY TO DYEING.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap and synthetic detergents.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, fustic, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, and iron buff.

Coal-Tar Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

In addition to the lectures in Textile Chemistry and Dyeing practical laboratory work is required of Course IV students. The action of chemical reagents on the various natural and manufactured textile fibers is studied, as well as the preparation of these fibers for dyeing. Some time is also spent in studying the bleaching processes on all fibers. A systematic study of the application of the different classes of dyes to cotton, wool, silk, various rayons and union materials, is carried out. Each student is required to keep a notebook containing samples of treated or dyed material and all data regarding the processes used.

A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work. Text: Bleaching & Finishing of Cotton by Trotman & Thorp. [Course IV.]

TEXTILE CHEMICALS—C-21a. This course consists of a series of lectures taking up the various processes preliminary to dyeing. Dyeing methods with special reference to the chemical compounds used in these processes are also considered. [Course VI.]

QUANTITATIVE ANALYSIS—C-22. PREPARATION: C-12. The object of this course is to teach the fundamental principles of quantitative analysis including analytical calculations, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1946 Edition and the 1947 Edition of "Calculations of Analytical Chemistry" by Hamilton & Simpson are used as texts. [Course IV.]

QUANTITATIVE ANALYSIS—C-22a. PREPARATION: C-12. The object of this course is to prepare the student for Course C-43 (Chemical Textile Testing). Instruction is given in the use of the analytical balance, in the determination of moisture and ash in fabrics, and in the titration of acids and bases. [Course V.]

MATHEMATICS—C-23. Two hours per week are devoted to the application of calculus and other mathematics to chemical and textile problems. [Course IV.]

FIBRE PROPERTIES—C-24. PREPARATION: C-10, C-11, B-12, B-13. A study of the physical and chemical properties of the artificial fibers in comparison with the natural fibers which they sometimes replace and with which they are frequently used. The advantages and disadvantages of each fiber for particular uses are discussed. [Course V.]

QUANTITATIVE ANALYSIS—C-30. PREPARATION: C-22. The fundamental principles acquired in Course C-22 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. [Course IV.]

Parts II & III of Mahin's "Quantitative Analysis" supplemented by A.A.T.C.C. "Methods of Analysis" and Federal Specifications.

ADVANCED TEXTILE CHEMISTRY AND DYEING—C-31. PREPARATION: C-21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Dyeing—For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse.

Dye House and Finishing Plant Management.—A study of the organization and management of the modern bleacheries, dyehouses and finishing plants.

Mill Visits. — During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. Text: Whittier & Wilcock, "Dyeing with Coal Tar Dyestuffs." [Course IV.]

ORGANIC CHEMISTRY—C-32. Preparation: C-11. The purpose of this course is to lay a broad foundation for the understanding of the basic principles of organic chemistry. The first semester consists of illustrated lectures and recitations covering the aliphatic series. The second term is devoted to the aromatic compounds. A number of problems are assigned as home exercises in order to fix the fundamental principles of the science in the student's mind. Books: Wertheim—Organic Chemistry and E. H. Huntress—Problems in Organic Chemistry. [Course IV.]

PHYSICAL CHEMISTRY—C-33. Preparation: B-10, C-10. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Three hours per week of Physical Chemical Laboratory are required during second term. [Course IV.]

TEXTILE LITERATURE—C-34. The object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

TEXTILE CHEMISTRY—C-35. Subject matter similar to C-21. Two lectures a week during the first term and one hour a week during the second term. Three hours laboratory during the second term. [Courses I, II, III.]

CHEMICAL TEXTILE TESTING—C-40. Preparation: C-21, C-31. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing. — Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing. — Inorganic extraneous matter: ash, ash alkalinity, silk weighting, acids and alkalies. Organic extraneous matter: scouring loss, extraction, sizing and finishing materials. Fiber mixtures: qualitative analysis, quantitative analysis. Swelling and damage in cellulose fibers: qualitative tests, barium activity number, ash alkalinity, solubility in sodium hydroxide, Methylene Blue absorption, copper number, fluidity. Damage to wool: lead acetate test, thiocyanate test, Pauly test, methylene blue test, sulfur content, total nitrogen content, soluble nitrogen, ammonia nitrogen, solubility in dilute alkali. Damage to silk: Zimmermann test, total nitrogen, ammonia nitrogen, viscosity in zinc chloride.

Optical Testing. — Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

ORGANIC CHEMISTRY LABORATORY—C-41. Preparation: C-32. A number of typical organic compounds are synthesized by general methods. A special problem is also assigned to train the student in longer or more difficult syntheses. Laboratory Book: Gatterman-Wieland—Laboratory Methods of Organic Chemistry. The second semester is devoted to the qualitative identification of organic compounds. Laboratory book: Mulliken-Huntress—Identification of Organic Compounds. [Course IV.]

MICROSCOPY—C-42. PREPARATION: C-32, B-23, C-21. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon. [Course IV.]

COLLOID CHEMISTRY C-43. PREPARATION: C-33. A lecture course on general colloid chemistry followed by its applications to textiles.

GENERAL.—Adsorption, surface tension and wetting-out, viscosity, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of the "irreversible emulsoids," protective colloids, mechanism of detergency and study of commercial detergents, gels and the Donnan Membrance Equilibrium, use of X-rays, properties of proteins, iso-electric point, plastics and plasticity.

TEXTILE APPLICATIONS.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, cellulose esters and ethers, rayons, starch, pectins and gums, silk, silk weighting, wool, wool scouring, crabbing, fulling wool shrinkage, casein wool, nylon, synthetic resins of all types, but particularly those used in textile finishing, theories of dyeing and printing. [Course IV.]

ADVANCED TEXTILE CHEMISTRY AND DYEING—C-44. PREPARATION: C-31. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

CLASSIFICATION AND MOLECULAR STRUCTURE OF ARTIFICIAL DYESTUFFS.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

ECONOMICS OF THE DYEING, BLEACHING AND FINISHING INDUSTRIES.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

ADVANCED DYEING CONFERENCE.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.] Text: Cain & Thorpe—Synthetic Dyestuffs and Intermediate Products.

CHEMICAL ENGINEERING—C-45. PREPARATION: B-20a. This course covers descriptive and quantitative information on the following branches of chemical engineering: flow of fluids, flow of heat, hygrometry, humidification and dehumidification, drying, textile drying, materials of construction, and any of the other unit processes for which there is time. The course consists of lectures supplemented by the working of numerous practical problems. [Course IV.]

ELECTIVE SUBJECTS OR THESIS DURING FOURTH YEAR—C-46. PREPARATION: SATISFACTORY COMPLETION OF ALL FIRST AND SECOND YEAR SUBJECTS IN COURSE IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind several electives have been introduced, each elective period consisting of 6 hours a week for the second term. Two electives are required.

THESIS. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

ADVANCED MICROSCOPY. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

TEXTILE CHEMISTRY LABORATORY. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

MICROBIOLOGY I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

MICROBIOLOGY II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

RAYON. Advanced study of rayon dyeing.

ADVANCED PREPARATIVE CHEMISTRY. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE—CHEMICAL ENGINEERING. PREPARATION: B-11, B-12, B-13, B-23, C-21, C-22. A combination of lectures and laboratory work designed for the study of the thermal properties of fluids, laws of thermo-dynamics as applied to batch and flow processes, flow of heat, mechanical mixtures, and heat engines.

This course will include such practical applications to the dyeing, printing, and finishing branches of the textile industry as efficient use of steam in heating dye kettles—steam traps—measuring of steam used—calculating steam costs—study of best methods of piping steam for manufacturing purposes and economics of hot water storage.

Compression and fluid handling, testing of pumps, fans and similar chemical engineering equipment including some calibration of instruments will serve to give the student a general over-view of elementary chemical engineering.

GLASS BLOWING. A course in the elements of laboratory glass blowing, designed to give the man going into laboratory work a familiarity with the methods of handling both soda glass and Pyrex. All the ordinary seals and joints used in construction of apparatus are described and tried out in the laboratory.

COLOR MATCHING. A further study of the principles involved in color matching accompanied by actual matching in the dyeing laboratory of many dyed samples of a variety of colors.

ADVANCED ORGANIC CHEMISTRY. This course deals with theoretical organic chemistry and the biochemical aspects of the science such as the isolation, proof of structure and synthesis of physiologically important compounds and the chemistry of synthetic compounds of biochemical interest.

TEXTILE DESIGN AND WEAVING—D

TEXTILE DESIGN, WEAVES AND YARN NUMBERING D-10. One term. Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from the design, and vice versa; extending and extracting weaves. The various topics taken up are relation and determination of counts of cotton, woolen, worsted, silk, and yarns made from the great variety of vegetable and synthetic fibers; grading of yarns, folded, ply, novelty and fancy yarns. [Course III.]

TEXTILE DESIGN, D-10a. One term. This is essentially the same as D-10 but is covered in two-thirds the time. [All courses except III.]

HAND LOOM WEAVING D-11. One term. This work precedes power weaving and consists of making original patterns and cloth construction. This subject correlates with the textile design work and aims to stimulate and inspire the student-designer to realize possible combinations of weave and color in a variety of yarns to produce fabrics for different purposes. [Course III.]

FREEHAND DRAWING—D-12. One term. This subject consists of freehand practice, by means of progressive steps, in training the eye to see accurately and to develop skill in depicting desired effects. It includes quick sketching and finished drawings of objects and of nature to build a drawing vocabulary which will be an aid to decorative expression. [Course III.]

PERSPECTIVE—D-13. One term. This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye. This aids the student in freehand drawing. [Course III.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-20. PREPARATION: D-10. Two terms. *For Cotton and Synthetic Fabrics.* In the first term consideration is given to fancy and reverse twills, damasks, skip weaves, sateen fabrics with plain ground. In the second term fabrics studied are those having extra warp and extra filling figured patterns. Both terms include the analysis of the fabrics as well as the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Course III.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-21. PREPARATION: D-10. Two terms. *For Woolen, Worsted and Synthetic Fabrics.* In the first term instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second term instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas and extra warp and filling figures. [Course III.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-26. PREPARATION: D-10a. Two terms. *For Cotton and Synthetic Fabrics.* This subject covers in brief only the basic fabrics contained in D-20 and D-30. [Courses I, V, VI S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-26a. PREPARATION: D-10a. One term. *For Cotton and Synthetic Fabrics.* This is a skeleton course patterned after D-26. [Courses VI G, VI E.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-27. PREPARATION: D-10a. Two terms. *For Woolen, Worsted and Synthetic Fabrics.* This subject covers briefly only the basic fabrics contained in D-21 and D-31. [Courses II, VI S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-27a. PREPARATION: D-10a. One term. This is a skeleton course patterned after D-27. [Courses VI G, VI E.]

DECORATIVE DESIGN—D-22. PREPARATION: D-12. Two terms. Through the principles of decorative design an understanding is acquired for the proper balance, distribution and repetition of motifs suitable for both the woven and the printed pattern. Historic designs of different periods and peoples are covered to supply the student with a background of decorative information. This source of inspiration is coupled with modern thought and application, as an aid to producing appropriate present day decorative textile. [Course III.]

PROPERTIES OF FABRICS D-23. PREPARATION D-10; D-10a. One term. The contents of this subject enables the student to recognize the many fabrics used today. It includes definite information on fabrics used for wearing apparel, home furnishings and industrial uses. [Course IV.]

WEAVING—D-24. PREPARATION: D-10. Two terms. Lectures and demonstrations are given covering all methods of warp preparation and include cotton, synthetic, woolen, worsted, and mixed fiber yarns. The warp preparation also covers slashing as well as rayon and synthetic soaking. Practical work is carried out on the machinery in the laboratory. The second half of this course deals with weaving on a cam loom, the identification of parts, principal and auxiliary motions, comparison to other type looms, and defects of weaving; laboratory work supplements the lecture work by a series of achievements. [Course III.]

WEAVING—D-24a. Two terms. This subject includes the same lectures and demonstrations as D-24 but requires only one-half the laboratory time. [Courses I, II.]

WEAVING–D-24b. Two terms. This subject includes the same lectures and demonstrations as D-24 but requires no laboratory work. [Courses VI G, VI E, VI S.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-30. Preparation: D-20. Two terms. *For Cotton and Synthetic Fabrics.* This work takes up the more complicated weaves adapted to harness work, and includes the following fabrics: Extra warp and extra filling checks and clipped spots, together with original layouts as might be required by a mill to produce a new pattern; Bedford Cords, Piques, Velveteens, Corduroys, Collar fabrics, multi-ply fabrics and narrow webbing. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs, both modified and original, the calculations involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value. Instruction in this subject is intended to bring together the principles considered under the subject of design, cloth construction, weaving, and yarn making of previous years and to show the bearing each has in the successful construction of a fabric. [Course III.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-31. Preparation: D-21. Two terms. *For Woolen, Worsted and Synthetic Fabrics.* This includes cost estimated for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs; the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, counts of yarn and value. Particular attention is given the construction of new designs by the use of suggestion sheets; the new fabrics to be constructed upon a base fabric, previously analyzed, along the lines outlined on the suggestion sheets, and to keep within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. [Course III.]

WEAVING—D-32. Preparation: D-24. Two terms. The lectures and demonstrations cover dobby weaving and include single and double index, single and double cylinder, chains, timing, and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics, silk and narrow webbing. This course also covers pile cloth weaving, carpet weaving and leno weaving. Laboratory work supplements the lecture work by a series of achievements. [Course III.]

WEAVING—D-32a. Preparation: D-24a. Two terms. This subject includes the same lectures and demonstrations as D-32 but requires only one-half the laboratory time. [Courses I, II.]

WEAVING—D-32b. Preparation: D-24b. Two terms. This subject includes the same lectures and demonstrations as D-32 but requires no laboratory work. [Courses VI G, VI E, VI S.]

COLOR—D-33. One term. This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks, plaids and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question. [Courses III, VI S.]

COLOR—D-33a. One term. This is a lecture course covering the same information as D-33 and applied entirely to cotton fabrics. [Course I.]

COLOR—D-33b. One term. This is a lecture course covering the same information as D-33 and applied entirely to woolen and to worsted fabrics. [Course II.]

TEXTILE DESIGN D-34. Preparation: D-10, D-10a. One term. Consideration is given to the analysis and comparison of various synthetic fabrics, as to the construction, denier of the yarn, filament count, weave and finish. Some time is also spent in analysis of spun rayon and allied cloths. [Course V.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-40. Preparation: D-30. *For Cotton and Synthetic Fabrics.* In this course consideration is given to the more complicated fabrics including elastic fabrics, both narrow and wide woven. Marseilles Quilting and Toilet Cloths. A working knowledge of the principles involved in the production of Cappet and swivel patterns, and the analysis of such fabrics is explained. A full course in leno design, from plain gauze to the more fancy leno woven patterns, using the modern steel doup and superdoup, is included. [Course III.]

TEXTILE DESIGN AND CLOTH CONSTRUCTION—D-41. Preparation: D-31. *For Woolen, Worsted and Synthetic Fabrics.* This includes analysis and reproduction of ply fabrics and combinations of work as outlined on suggestion sheets in D-31. Principles of construction of Wiltons, Brussels, and Axminster rugs and carpeting are also explained. Laboratory instruction is given in the identification of various textile fibers. In connection with this work samples are analyzed for quality and quantity of fibers present. [Course III.]

JACQUARD DESIGN AND WEAVING—D-42. Preparation: D-10, D-22. Two terms. This subject correlates with the instruction in weaving of the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics. The student is taught to transfer his original sketch to cross section design paper, choose the proper weave for both the background and foreground, cut cards and lace, and weave the fabric. [Course III.]

JACQUARD DESIGN—D-42a. Preparation: D-10. One term. The student is taught to transfer a given motif to cross section paper, choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to appreciate the complete operation from the motif to the loom. [Course VI S.]

LANGUAGE AND HISTORY—E

ENGLISH—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

ELEMENTARY GERMAN—E-11. Preparation: Admission Requirements. This course is intended for students who do not offer German as an extrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

BUSINESS ENGLISH—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [All courses.]

ADVANCED GERMAN—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

APPRECIATION OF LITERATURE—E-22. This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Although there will be emphasis upon literary technique, the constant aim will be to keep this phase subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals — the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. [Courses I, II, III, V, VI.]

MODERN WORLD HISTORY—E-23. This course, which is elective, meets three times each week. It consists of lectures, reading assignments, and discussion periods. The subject matter content is based upon a consideration of the following seven characteristics of modern history: democracy, liberalism, nationalism, industrialism, militarism, imperialism, and the progress of science and humanitarian ideals. The format of the course is sufficiently flexible to permit continuing emphasis upon those areas of modern world history which seem likely to be most important and meaningful to students entering upon careers in the textile industry. The general purpose of the course is to secure an understanding of present-day events and institutions by stimulating an appreciation of the factors responsible for their evolution and development. [Courses I, II, III, V, VI.]

ECONOMICS—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [All Courses]

SOCIOLOGY—E-40. This course meets three times each week, and is conducted by means of lectures, reading assignments, and discussion periods. The subject matter includes consideration of such topics as human personality, social psychology, social organizations and institutions, collective behavior, social drives, human culture, industrial and business psychology, and the possibilities of human progress. Theoretical precepts are illustrated by constant reference to real-life situations in the business and social world; case studies constitute an integral part of the course; and from time to time provision is made also for inclusion of research-type projects for individual and group investigation: The purpose of the course is to stimulate an understanding and appreciation of the fundamental principles motivating human behavior, as individuals and as members of social groups. [All Courses]

LABOR RELATIONS—E-41. Preparation: E-10. This course is a survey of the background and character of modern labor problems—security and insecurity in modern society, unemployment, physical risks of industry, old age, wages, and hours. It includes an appraisal of the effects of labor problems upon the worker, the employer and the general public; the historical development of labor organizations; their influence in modern industry; their relations to government; the problem of labor contracts. These problems are analyzed with particular reference to the textile industry. The course is conducted by means of lectures, reading assignments, and discussions, and includes frequent talks by men active in the fields of management and labor, men who know the practical application of these principles in actual industry. [Courses I, II. III, V]

COTTON YARNS AND KNITTING—F

COTTON CARDING—F-20. Preparation: B-10, B-12, B-13. This course is given in the first term of the second year and includes instruction regarding the growth, classing and handling of raw cotton and the processes of opening, picking and carding. Considerable time is spent studying cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. The basis of cotton classing is thoroughly covered here and the general background of how cotton is bought and sold is explained.

The mill processes of opening, picking and carding, and the many different types of machines in use are thoroughly studied. Special textbooks with many illustrations have been prepared so that the student may devote his entire attention to class discussions. The calculations pertaining to the various operations are covered in detail. The various settings possible and their effect on quality or production are made clear also.

The laboratory work for this course includes classing practice, fiber study and comparison, waste tests and comparisons, and studies of machine constructions and gearings. [Course I.]

COTTON CARDING—F-20a. Preparation: B-10, B-12, B-13. This course includes the same lectures as course F-20 but the time devoted to laboratory work is reduced. [Course VI G.]

COTTON CARDING—F-21. PREPARATION: F-20. This course, given in the second term of the second year, is a continuation of the work of the first term and includes work on carding, combing, drawing and roving. Here again, special textbooks have been prepared with many illustrations, showing machine cross-sections and details of different actions and parts. While the main part of the work is to clearly explain the purposes and principles of each machine, all the various calculations and settings pertaining to each are carefully studied and problems are assigned for student practice.

The laboratory work required in connection with this course includes a series of specific experiments illustrating various phases of the work of each operation. Other laboratory work consists in processing various lots of cotton in preparation for spinning. [Course I.]

COTTON CARDING—F-21a. PREPARATION: F-20a. This course includes the same lectures as Course F-21 but the time devoted to laboratory work is reduced. [Course VI G.]

COTTONS F-22. PREPARATION: F-20 TAKEN SIMULTANEOUSLY. This course consists of lectures and laboratory work, supplementary to Course F-20, for those students who study cotton only. Some time is spent on the details of cotton fiber growth and structure and in comparing cotton with other fibers. The economic importance of cotton is studied and sources of information regarding cotton and its processing are given to the class. [Course I.]

COTTON WASTE PROCESSING—F-23. PREPARATION: F-20, F-21 TAKEN SIMULTANEOUSLY. For those specializing in Cotton Manufacture, this course provides a survey of the methods and machinery used in processing cotton wastes, or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment and the manufacturing processes. Samples of wastes and products are used to demonstrate the possibilities in this field.

The laboratory work provides practice with some wastes and their processing. [Course I.]

SYNTHETIC YARN, COTTON SYSTEM—F-24. PREPARATION: B-10, B-12, B-13. This course, which continues through the entire second year, provides instruction regarding standard machinery used in cotton manufacturing. As much staple fiber is spun on this type of equipment, the work of the course parallels that normally given to students in Cotton Manufacturing. Instruction covers opening, picking, carding, combing, drawing and roving machinery, its construction, principles of operation and the calculations regarding each of the operations.

A limited amount of time is devoted to laboratory practice to demonstrate the machinery being studied, showing actual commercial machines producing material to be used in later operations. [Course V.]

COTTON SPINNING—F-30. PREPARATION: F-21. This course is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning. Such details as spindles, rings, travelers and builders are carefully explained and such factors as twist, contraction and strength of yarns are thoroughly studied. Particular consideration is given to the production of yarns for different uses and how desired characteristics may be obtained. All the calculations regarding yarns and spinning frames are thoroughly studied and problems are assigned for student practice.

The laboratory work for this course includes a series of specific experiments and tests illustrating important phases of the operations and practice in spinning various counts from roving which the students have made previously. [Course I.]

COTTON SPINNING—F-30a. PREPARATION: F-21a. This course includes the

same lectures as Course F-30 but the time devoted to laboratory practice is shortened. [Course VI G.]

COTTON WINDING AND TWISTING—F-31. PREPARATION: F-30. This course is a continuation of the course on spinning, in which the instruction includes the conclusion of spinning, spooling and the various types of winding, twisting of common and fancy yarns and such incidental features as reeling, baling, mule spinning and rope manufacture. (Some of these items are optional.) All the calculations regarding winders and twisters are thoroughly studied and problems are assigned for student practice.

The laboratory work includes specific studies, experiments and yarn analyses. Other work required involves the winding of yarns under various conditions and the production of plied yarns to meet specified construction. [Course I.]

COTTON WINDING AND TWISTING—F-31a. PREPARATION: F-30a. This course includes the same lectures as Course F-31 but the time devoted to laboratory practice is shortened. [Course VI G.]

STAPLE FIBER MANUFACTURE—F-32. PREPARATION: F-21, F-30. Using the preparatory courses as a background, this course offers a study of the methods of manufacture of various staple fibers, such as wool, rayon or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the course is planned to take advantage of the new developments as they appear. Considerable of the work in this course is of the discussion type, which aims to correlate all the work on yarn manufacture and bring it to bear on the processing of staple fibers. [Course I.]

COTTON QUALITY CONTROL—F-33. PREPARATION: F-21, F-30. While it is customary to point out defects in the materials during the processing in all the laboratory work, this course provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this course. Every effort is made to develop the student's diagnostic ability so that he may readily recognize and remedy new defects as he meets them. [Course I.]

COTTON MANUFACTURE SURVEY—F-34. For students with but a secondary interest in Cotton Manufacture, this survey course outlines the processes used and the principles involved in cotton yarn manufacture. The first semester covers cotton qualities and production and the processes through combing. The second semester starts with drawing and completes through spinning, winding and twisting.

While this course is primarily lectures, it is planned to include some laboratory demonstration. Outside preparation will include some study of the standard manufacturing machinery in the laboratory. [Courses II, III, VI E, S.]

SYNTHETIC YARN, COTTON SYSTEM—F-35. PREPARATION: F-24. Running through both terms of the third year, this course continues the work of staple fiber manufacture on the Cotton System. The major topics are ring spinning, winding and ring twisting. The subject matter of the lectures covers the construction and principles of regular and long draft spinning equipment, various types of winders and plain and fancy twisters. The calculations for the operations are included, along with analysis and reproduction of various yarns.

A limited amount of time is devoted to laboratory exercises demonstrating these operations and producing various single and ply yarns. [Course V.]

MILL ORGANIZATION—F-40. PREPARATION: F-31, F-31a. This course cor-

relates all the work on Cotton Manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and the handling of staple fibers are carefully covered. The machinery necessary to keep plants in balance is calculated, with some consideration of the best arrangements for economical handling. Some time is given to the use of efficiency work and end breakage studies for cotton mills. [Courses I, VI G.]

MANAGEMENT PROBLEMS—F-41. PREPARATION F-31 and F-40 taken simultaneously. This course supplements the course in Mill Organization with some added detail regarding the work in Organization. In addition, this course includes work on equipment arrangement for practical routing and operation, auxiliary equipment necessary for manufacturing efficiency, job descriptions and job assignments. [Course I.]

KNITTING—K-40. PREPARATION: B-12, D-10. This course is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

The laboratory work consists of a series of carefully organized experiments in which the students operate standard machines to produce some knitted article or fabric. Auxiliary equipment for transferring, looping and sewing is available if needed. Fabric and hosiery analysis are included in this work. [Courses I, II, III, V.]

KNITTING—K-40a. PREPARATION: B-12, D-10. This course embraces the same lectures as Course K-40 but has only one-half laboratory time. [Courses VI G, E, S.]

KNITTING—K-41. PREPARATION: K-40. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Courses I, II, III, V]

WOOL—G

FIBER PREPARATION—G-20. PREPARATION: B-12, B-13, C-10. RAW MATERIALS.—A study of fibrous materials which can be spun into manipulated type yarns by the woolen or worsted system of manufacture, includes animal, vegetable and synthetic fibers.

WOOL CLASSIFICATION.—Breeds of sheep, wool grading and sorting, are covered in lecture and laboratory with emphasis on blood and count classification of fiber and methods of shrinkage determination.

WOOL SCOURING.—The cleansing of grease wool by the emulsion and solvent methods is covered from opening to drying, with emphasis on temperatures, soaps, chemicals, and reclamation of by-products.

CARBONIZING AND BUR PICKING.—Various methods of removing vegetable matter from wool are explained and practiced.

REWORKED FIBERS.—Hard and soft mill wastes are explained and observed as well as rag sorting with all processes used in converting rags to fiber. [Courses II, VI, Options G.]

TOP MAKING—G21. PREPARATION: B-10, B-12, B-13. WORSTED CARDING.—Lectures and laboratory work cover all details of the worsted card necessary to produce well opened sliver of wool or synthetic fibers.

BACK WASHING.—The back washing of carded sliver is fully covered.

GILLING.—The principle of gilling is explained and observed on both open and intersecting machines.

COMBING.—The operation of both Noble and French combs is covered in lectures and laboratory work with emphasis on comparative adjustments for natural and synthetic fibers.

BLENDING.—The calculations and methods used in making blends of colors or mixtures of fibers are explained and practiced. The cutting of synthetic tow into uncombed top is explained.

TOP.—Top analysis, stapling and classification is explained as well as marketing methods. [Courses II, VI, Option G.]

SYNTHETIC YARNS, WOOL SYSTEM—G-22. PREPARATION: B-10, B-12, B-13. Details of special operations necessary to produce woolen type yarns from synthetic fibers are fully covered. [Course V.]

WOOLEN YARNS—G-30. PREPARATION: G-20. FIBER BLENDING, OILING AND PICKING.—Various methods of blending and opening of fiber mixes are covered in lecture and laboratory. The importance of oils and emulsions is discussed in detail.

WOOLEN CARDING.—The basic principles of carding are explained and observed. The construction, operation and maintenance of both ring and tape condenser cards is covered in detail.

WOOLEN SPINNING.—The principle of drawing and spinning fibrous materials into yarn is covered thoroughly in lectures and laboratory with emphasis on the details of the construction, maintenance, and operation of the woolen mule and spinning frame.

TWISTING.—Yarn conditioning is discussed as well as methods of producing fancy twists and novelty yarns for knitting or weaving. [Courses II, VI, Option G.]

WORSTED YARNS—G-31. PREPARATION: G-20, G-21. TOP ANALYSIS.—Top stapling and analysis necessary for correct adjustment of drawing and spinning machinery is observed and discussed.

WORSTED DRAWING.—Methods, calculations and adjustments of machinery necessary to draw top ready for spinning on both French and English systems are explained and practiced.

SPINNING AND TWISTING.—Various methods of spinning are thoroughly explained and practiced with some emphasis on twisting for knitting or weaving yarns. [Courses II, VI, Option G.]

SURVEY OF WOOL MANUFACTURE—G-32. PREPARATION: B-12, B-23, D-20, D-24. This course of 90 hours is a complete survey of the fundamental theory and practice of the operations necessary to produce yarn on the woolen and worsted systems of machinery. Subjects covered include breeds of sheep, wool grading, sorting, scouring, carbonizing; wool wastes, reworked wool, synthetic staple; types of wool cloth; woolen-blending, oiling, picking, carding, spinning and twisting; top making-worsted carding, backwashing, gilling, combing, top analysis; worsted yarns — French and English drawing, spinning, twisting; yarn conditioning calculations. Operational and maintenance details are eliminated to provide an excellent routine for Courses I, III, V, VI E, S, and graduate students.

SYNTHETIC YARNS, WOOL SYSTEM—G-33. PREPARATION: G-22. Details of special operations necessary to produce worsted type yarns from synthetic fibers are fully covered. (Course V.)

WOOLEN ORGANIZATION—G-40. PREPARATION: D-20, D-24, B-22, C-21, G-20, B-31, G-30, B-43b. Thirty hours of lectures serve to recapitulate the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system. [Courses II, VI—Option G.]

WORSTED ORGANIZATION—G-41. PREPARATION: D-20, D-24, B-22, C-21, G-20, G-21, B-31, G-31, B-43b. Fifteen hours of lectures summarize previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades. Fifteen hours are also used to cover balanced mill equipment necessary to produce worsted cloth from top on both English and French systems. [Courses II, VI—Option G.]

FINISHING—H

WOOLEN AND WORSTED FINISHING—H-40. PREPARATION: B-12, C-10, D-10, D-24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

BURLING AND MENDING.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing processes, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

FULLING.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oils, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, V, VI, G, S.] [Course V omits Carbonizing, Gigging and Napping.]

COTTON FINISHING—H-41. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses, — steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking.

The outline of the course in the finishing of synthetic fabrics is as follows:

Cloth Room.—Instruction in the handling of the various fabrics.

Singeing.—The object of singeing; the construction of the various types of singers; the object of the different methods of cooling.

Washing. — Open width, string and slack rope, and the object thereof.

Quetch and Mangles.—The object and construction.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, net dryer, tenter frames, clips, button breakers, etc.

Silk Calenders.—The object and construction, including the regulation of pressures.

Decator.—The reason for and the methods used.

Make-up Room.—Yarding, inspecting, winding, pressing and papering. [Courses I, III, V, VI, G, S.]

EQUIPMENT

The equipment of machinery, inventoried at $750,000.00, is most varied for textile educational purposes, and is being constantly augmented. The builders

of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

COTTON YARN DEPARTMENT.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a special section with north light, where Universal Standard Grades, Government Staple Standards, and many different commercial cottons, American and foreign, are available.

The opening and picking equipment consists of one Saco-Lowell Vertical Opener and a 40-inch Saco-Lowell Three Beater Single Process Picker with a Blending Reserve.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

For drawing, there is a two delivery Howard and Bullough head equipped with metallic rolls and electric stop motion. From the Saco-Lowell Shops, there is a railway head and two four delivery heads, one of which is equipped with a Chapman Neutralizer.

The roving section has a Woonsocket 8 x 4 frame with Whitin Superdraft equipment, a full line of regular roving machines—Slubber Intermediate, Fine and Jack from the Saco-Lowell Shops and a Fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. Two are equipped with the latest Saco-Lowell Roth Long-Draft System. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman Ball-Bearing Spindles. The Whitin Machine Works is represented by five frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF Roller-Bearing Spindles and is fitted on one side with Casablanca Long-Draft equipment. Two of these frames are the Fales and Jenks type, one of which has 36 spindles with one side equipped with Casablanca Long Draft system. The other is a 72 spindle frame equipped with the latest Whitin Long Draft system. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. An Asa Lees Company mule, suitable for counts above 30's, has been retained to illustrate this peculiar type of spinning.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end 20-inch derby doubler; a 40-inch four coiler finisher card and a combination slubber-intermediate. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. A seriplane yarn winding device and a Saco-Lowell Sliver Tester are used for examining variability of yarns and slivers. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser. Other equipment for use in fiber study consists of a Baer Sorter, a hand microtome and projecting apparatus for drawing fiber detail.

KNITTING SECTION.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns, and a Foster winder suitable to wind cones or tubes.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; two Dubied scarf machines, and a Raschel warp knitter.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines and a Mayo model C full automatic. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3–5¼ and arranged for needles varying in number from 100–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of a Scott & Williams ribber, a Wildman ribber, a single head Crane spring needle machine and a two head Tompkins spring needle machine. Melting pots and molds are available for leading needles.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 20-point looper with an individual table and motor drive and a variety of sewing machines suitable for welting, seaming, and finishing underwear and outerwear.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

WOOL YARN DEPARTMENT.—The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60 x 40 three cylinder set of cards with Garnet Breast, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48 x 40 cards with single breaker, intermediate, and

finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule; one 20 spindle 2½-inch ring twister for novelty yarns.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle giant package cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders and one roll grinder complete.

REWORKED FIBER DIVISION.—Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are many samples of reworked wool in all stages from rags to fiber.

WOOL PREPARING DIVISION.—Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Many samples of all types of wool are available for study.

TOP MAKING DIVISION.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, backwasher, with Taylor-Wordsworth & Co. gill box, equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells; one Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device.

WORSTED YARN DIVISION.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

FRENCH SYSTEM.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Société Alsacienne de Constructions Mechaniques, and the equipment consists of the following: third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

TESTING EQUIPMENT.—A conditioned room is available for routine testing.

Testing machines include the following: Henry L. Scott & Company skein and fabric tester; one Emerson conditioning oven with Toledo scales; one Bausch & Lomb projecting microscope for fiber analysis; one Alfred Suter top stapling machine with scales; one top inspection stand with duplex mercury lamp lighting; one Edgerton stroboscope; five copper bowls for scouring by hand; complete set of U. S. wool standards for fiber comparison.

DESIGN AND POWER WEAVING DEPARTMENT.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation room, the cotton section includes a Universal cone winder, an Entwistle warper and a Saco Lowell slasher. The woolen and worsted section includes two jack spoolers, one wet and one dry dressing frame, an 82-inch reel, and 94-inch reel, and one double head beamer all supplied by the Davis & Furber Machine Co. The silk and rayon section includes a winder, narrow warper and beamer.

The filling winding section contains a Universal No. 90 winder and a Davis & Furber 40-end jack winder.

The winding machinery includes No. 10, No. 50, No. 90 and No. 60 and No. 60 G.F. Universal Winders and a Johnson & Bassett Jack Winder.

The weave room contains a total of 52 power looms. The cotton section of 29 looms includes one wide sheeting loom, one wide blanket loom, one wide tablecloth loom, and 18 narrow looms for sheeting, towels, shirting, etc., and eight Jacquard looms for towels, napkins, dress goods, overdrapes, etc. The woolen and worsted section contains three wide worsted looms, one blanket woolen loom, and eight narrow Crompton & Knowles box looms for suitings, coatings, and blankets. The silk and rayon section of 5 looms includes two wide looms, one narrow loom, and two Jacquard looms for shirtings, dress goods, overdrapes, etc. Other looms of the weave room are: 1 wide tapestry loom, 2 narrow carpet Jacquard looms, 3 narrow fabric looms, and 6 assorted hand looms.

CHEMISTRY AND DYEING DEPARTMENT.—The General Chemistry and Qualitative Analysis Laboratory provides facilities for 120 students.

The Quantative Analysis Laboratory contains two steam plates, drying closets, a gas hot plate, a Kjeldahl digestion unit and electro-analysis apparatus. Special apparatus used by the advanced quantitative class includes the following equipment: Abbe refractometer, Becker chainomatic Westphal balance, two Saybolt Universal viscosimeters, 1 Engler viscosimeter, Pensky-Martin flash tester, two

Cleveland open cup testers, Conradson carbon residue apparatus, Titer test apparatus and Emerson oxygen bomb calorimeter. The balance room has 14 Christian Becker analytical balances and a Christian Becker calibration balance.

The Chemical Textile Testing Laboratory contains the following: Scott serigraph strength tester, Scott single strand strength tester, drying oven and analytical balance combination, twist counters, yarn reels, barometer, hygrometers, sling psychrometers, thickness gauge, duNuoy tensiometer, pick glasses, extraction apparatus, heat transfer apparatus, waterproofness apparatus and the usual chemical apparatus and balances.

The Organic Laboratory has the necessary equipment required in the preparation of basic organic compounds, also instruments such as autoclaves, electric and gas combustion furnaces used in the manufacture of dyes.

The Microscopy and Optical Testing Laboratory contains a polarizing microscope, binocular microscope, twelve ordinary microscopes, rotary microtome, table microtome, Hardy sectioning device, comparison ocular, vertical illuminator, camero lucia, a large number of microscope lamps of various types, dark ground illuminators, polarizing equipment, dipping refractometer, Abbe refractometer, several spectroscopes, Duboscq colorimeter, Lovibond tintometer, ultra violet and infra-red radiation sources, optical pH apparatus and the necessary auxiliary equipment.

The Experimental Dyeing Laboratory is equipped with steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine; a yarn dyeing machine by Klauder-Weldon Dyeing Machine Company; a James Hunter sample dyeing machine; a jig dyeing machine; a chain dyeing machine; 3 fadeometers; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

FINISHING DEPARTMENT.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6–4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6–4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydroextractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United

States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 80-inch 24-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

TEXTILE ENGINEERING DEPARTMENT.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower steam engine direct connected to an absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a surface condenser, or to a multi-stage steam turbine. A seven-stage steam turbine driving directly a 25 kilowatt alternating current generator and piped to exhaust steam either to the atmosphere or to the condenser. The turbine may be operated either as a high or low pressure steam unit and study made of the steam pressure at the various stages of the turbine. The alternator has special connections to illustrate various commercial phases. In addition there are a triplex power pump, two 2-inch centrifugal pumps, an air compressor, a ventilating fan unit, with the necessary tanks, scales and measuring instruments to conduct tests of all the equipment.

The Electrical Engineering Laboratories consist of three sections: electrical machinery, instrument, and electronic laboratories.

The electrical machinery laboratory is devoted to instruction in the generation and transmission of power and contains the necessary switchboard and instruments to control a 25 kilowatt alternating current turbogenerator, and a 15 kilowatt generator set arranged to supply either direct or alternating current with the other side of the machine acting as a motor. A direct current 10 H.P. motor generator set equipped with Prony brake for testing the shunt, series or compound wound motor while the other side can be run as a shunt or compound wound generator. A 5 H.P. 3 phase induction motor equipped with a prony brake, and three single phase laboratory transformers.

The instrument laboratory is designed to give instruction in the measurement of current, voltage, resistance, inductance, capacitance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard photometer with screen and illuminometer provide means for illumination measurements.

The electronic laboratory is equipped to study electronic action and the functioning of industrial electronic equipment. The equipment consists of 2 breadboarded dynamic demonstrators, 3 cathode ray oscillographs, chanalyst, signal generator, tube tester, electronic power supply, 2 electronic multi testers, delay relay, photoelectric relay, control relay, and breadboards for determining tube and circuit characteristics.

The Physics Laboratory contains the usual standard equipment required for laboratory work in elementary college physics. In addition it is equipped with apparatus for advanced instruction and research in textile physics. The following devices are available: brightness meter with polarizing photometer, electrical conductivity apparatus, heat transmission apparatus, high voltage electrostatic equipment, micro-balance, yarn uniformity tester, automatic load elongation recorder for yarn, monochromatic and white calorimeter, photoelectric spectrometer, trichromatic calorimeter.

The Microscopy Laboratory contains seven student microscopes, one binocular microscope with oil-immersion objective, one binocular stereoscopic microscope, rotary microtome, sectioning plates, camera lucidas, filar micrometer, polarizing accessories, dark-field condenser, vertical illuminator, microscopic projector, and many types of microscope lamps.

The Textile Testing Laboratory is a specially constructed and insulated room provided with air conditioning machinery to maintain automatically standard conditions of temperature and relative humidity. The laboratory has six strength testers of the pendulum and inclined plane types, and with suitable ranges of capacity to cover the requirements of fiber, yarn and fabric testing. It also contains two types of abrasion machines, a bursting tester, air permeability apparatus, two devices for testing water permeability, thickness gage, compression meter, friction meter, planoflex, compression meter, washing machine, launderometer, drying oven, twist testers and the usual accessories of a well-equipped laboratory.

The Machine Tool Laboratory contains equipment as follows: twelve engine lathes of 13″ to 18″ swing and bed lengths from 6′ to 10′, five speed lathes of 7″ swing and 4′ bed, one precision lathe, two universal and one plain milling machine, four upright drills, one shaper, one planer, six grinders of various types, a centering machine, circular metal saw, power hack saw, gas furnace, as well as the usual accessories for bench work. The tool room is well-equipped with the many types of small tools and supplies needed for the work of instruction in the fundamentals of machine tool operation.

ALUMNI ASSOCIATION

The membership of the alumni association of the Institute is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year. Membership also includes Associate and Honorary classifications.

The Association holds its annual business meeting and banquet in the spring of each year.

Communications should be addressed to Prof. A. Edwin Wells, Secretary, Alumni Office, Lowell Textile Institute.

Officers and Directors for the Year 1947–48

J. Milton Washburn, Jr., '21, *President*

A. Chester Clifford, '22, *Vice-President*

A. Edwin Wells, '20, *Secretary-Treasurer*

Ernest P. James, *Assistant Secretary-Treasurer*

Scholarship Funds Committee

Carleton J. Lombard

Albert J. Gilet

Auditor

Nathaniel E. Jones

Directors at Large

Roger C. Griffin

Edward B. Bell

Harold Leitch

Royal P. White

Olin D. Gay

Milton Hindle

Herbert Wilkinson, Jr.

Frank Gainey

E. Perkins McGuire

Harold E. Clayton

Francis P. Madden

Richard W. Rawlinson

Simon Shapiro

Raymond R. Stevens

Samuel Pinanski

STUDENT ACTIVITIES AND ORGANIZATIONS

SCHOOL PUBLICATIONS.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

SOCIETIES.—There are four fraternities, three of which are national and one local, also one sorority. They afford opportunity for social life desired in a college career.

DRAMATIC CLUB.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

PROFESSIONAL CLUBS.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Chapter of the American Association of Textile Chemists and Colorists sponsors meetings addressed by speakers on technical subjects.

RIFLE CLUB.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

HONOR SOCIETY.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

HONOR ROLL.—The President's List includes upper classmen taking a regular course who have a high scholastic rating and no deficiencies.

STUDENT BOOK STORE.—A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

INTERNATIONAL STUDENTS CIRCLE.—The International Students Circle is an organization composed of all the students who have a legal residence in a country outside of the United States. Its objects are to promote good fellowship and better understanding through cultural, social, and technical activities. Two meetings are held each month at which textile subjects are discussed or speakers from the textile industry address the members.

GRADUATES OF 1946

Master of Science in Textile Engineering

Robert Shao Dunn, B.S., 1941
Chinese National Southwest Associated University

Bachelor of Textile Chemistry

Rita Pearl Landry*
Harry George Scarmeas
Albert Edmund Tamosauskas*

Bachelor of Textile Engineering

Frederick Frank Balas
Jesus Loredo de Blas
Albert Hyman Rovner

Candidates for Diplomas

Diploma in Cotton Manufacture
Ignacio Uriarte Daldini

Diploma in Wool Manufacture

Robert Mace Bent, Jr.

*Tau Epsilon Sigma (Textile Scholastic Society)

REGISTER OF DAY STUDENTS

GRADUATE STUDENTS

Home Address	*Lowell Address*
Abdel Maksud, Hussein, VI, Cairo, Egypt M.E., Fouad 1 University, 1940	49 Franklin Street,
Boule, George Raymond, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1942	66 Mt. Hope Street
Busby, John Carroll, Jr., VI, Salisbury, N. C. S.B., Comm., University of North Carolina, 1940	73 Nesmith Street
Chandra, Prakash, VI, Pakpattan, India M.E., Victoria Jubilee Technical Institute, 1946	25 Varney Street
Cheng, Fur-She, VI, Shanghai, China M.E., Kiangsu Provincial Technical College, 1938	25 Putnam Street
El-Gammal, Aziz Abdel-Kader, VI, Giza, Egypt E.E., Fouad 1 University, 1943	29 Middlesex Street, No. Chelmsford
Gaensly, Horst Ewaldo, VI, Curitiba, Brazil C.E., Universidade do Parana, 1943	8 Mt. Washington Street
Gorenstin, Carlos, IV, Rio de Janeiro, Brazil B.S., Escola Nacional de Quimica, 1944	21 Dunbar Avenue
Hillson, Harvey David, IV, Orono, Maine B.S., University of Maine, 1943	————
Kelakos, Charles George, VI, Lowell, Mass. B.T.E., Lowell Textile Institute, 1938	6 Rockdale Avenue
Landry, Rita Pearl, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1946	348 Hildreth Street
Lee, Ying Kong, VI, Shanghai, China B.S., St. John's University, 1944	43 Plymouth Street
Lins, Guilherme Borges, IV, Rio de Janeiro, Brazil B.S., Escola Nacional de Quimica, 1945	25 Upland Street, Dracut
Liu, Yu-Hsuan, VI, Sian, China B.S., National Central University, 1942 M.S., Massachusetts Institute of Technology, 1946	20 Walden Street
Lyra, Mario Souto, VI, Rio de Janeiro, Brazil B.S., Escola Nacional de Quimica, 1936	119 Sherman Street
Manudhane, Ramanarayan Gangadhar, IV, Bombay, India B.S., University of Bombay, 1943	27 Waverly Street
Marder, Solomon, VI, Rock Island, Illinois B.S., Cornell University, 1946	50 Standish Street
Meehan, Joseph Arnold, VI, Wollaston, Mass. B.S., Tufts College, 1945	91 Methuen Street
de Mendonca, Alvaro Olyntho do Prado, IV, Rio de Janeiro, Brazil B.S., Escola Nacional de Quimica, 1944	21 Dunbar Avenue
Moreau, Arthur Joseph, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1942	45 West Street
Politzer, Kurt, IV, Rio de Janeiro, Brazil B.S., Escola Nacional de Quimica, 1944	21 Dunbar Avenue
Pospisil, Jaromir Jan, VI, Wilber, Nebraska B.S., U. S. Military Academy, 1930	222 Varnum Avenue
Rao, Devalpalli Hanmanth, IV, Hyberabad, India B.S., Osmania University College, 1942 M.S., Osmania University College, 1944	25 Third Street

Home Address	*Lowell Address*
da Rocha, Ademar Vieira, IV, Rio de Janeiro, Brazil	25 Upland Street, Dracut
B.S., Escola Nacional de Quimica, 1945	
Shah, Champaklal Chimanlal, IV, Bombay, India	25 Third Street
B.S., Bombay University, 1943	
Singh, Kirpal, IV, Punjah, India	800 Merrimack Street
B.A., Khalsa College, 1930	
Valente, Jose Fernandes, IV, Rio de Janeiro, Brazil	25 Upland Street, Dracut
B.S., Escola Nacional de Quimica, 1945	
Vaughn, William Enoch, Jr., VI, Atlanta, Georgia	64 Woodcock Street
B.S., Georgia School of Technology, 1939	
Voong, Edith Tse Lieu, VI, Shanghai, China	50 John Street
B.S., Nantung College, 1944	
Willett, Robert Earle, IV, Alexandria, Va.	105 Littleton Road, Chelmsford
B.S., North Carolina State College of Agriculture and Engineering, 1938	
Woo, Henry, IV, Shanghai, China	56 Fourth Avenue
B.S., St. John's University, 1939	
Woodard, William Kenneth, VI, Atlanta, Georgia	8 Thissell Avenue, Dracut
B.S., Georgia School of Technology, 1943	
Yang, Yuan-Loong, IV, Shanghai, China	12 Warwick Street
B.S., St. John's University, 1943	
Yu, Chia-Ti, VI, Hankow, China	272 Merrimack Street
B.S., Georgia School of Technology, 1946	

UNDERGRADUATE STUDENTS CANDIDATES FOR DEGREES

Class of 1947

Allard, Claude Henry, IV, Lowell, Mass.	125 Nesmith Street
Bauer, Jerome Frederick, IV, Waterloo, Ont.	406 Pawtucket Street
Baum, Bernard Oscar, IV, Brookline, Mass.	494 Wilder Street
Bechard, Robert William, IV, Tyngsboro, Mass.	———
Bernard, John Joseph, IV, Lowell, Mass.	999 Moody Street
Cherenson, Alan Harold, VI, Chelmsford, Mass.	———
DeKalb, John Ernest, IV, Chelmsford, Mass.	———
Esielionis, Victor John, VI, Shirley, Mass.	———
Fishman, Sidney, VI, Brooklyn, N. Y.	137 Riverside Street
Foley, Eleanor Elizabeth, IV, Lowell, Mass.	120 Fulton Street
Gaulin, Blanche Annette, VI, Lowell, Mass.	429 Pawtucket Street
Gottlieb, Edwin Meyer, IV, Brooklyn, N. Y.	119 Stevens Street
Haggerty, Isabel Francis, VI, Lowell, Mass.	127 Fort Hill Avenue
Hallett, John Lawrence, Jr., VI, Boston, Mass.	———
Helfgott, Stanley Lee, VI, Brightwaters, N. Y.	184 Eleventh Street
Kaplan, Kalman, VI, Everett, Mass.	236 Salem Street
Klashman, Julian Bernard, VI, Cambridge, Mass.	52 Mt. Hope Street
Kopycinski, Joseph Valentine, IV, Lowell, Mass.	242 Branch Street
Kosowicz, Julian Frank, VI, Lowell, Mass.	9 Raymond Place
LaFrance, Henry Joseph, IV, Tyngsboro, Mass.	———
Langlais, George Olivier, IV, Lowell, Mass.	48 Riverside Street
Leshowitz, Harold, VI, Brooklyn, N. Y.	236 Salem Street
Levin, Madeline, IV, Lowell, Mass.	43 Ware Street

Home Address	*Lowell Address*
Levy, Leonard, VI, New York, N. Y.	77 Livingston Avenue
MacIntyre, Robert Gardiner, VI, Lowell, Mass.	32 Berkeley Avenue
MacLean, Philip Eugene, IV, Westford, Mass.	————
McMahon, Stillman Dillon, IV, Lowell, Mass.	7 Belmont Street
Marcus, Martin Bernard, VI, Brookline, Mass.	479 Westford Street
Martin, Paul Joseph, IV, Lowell, Mass.	34 Woodward Terrace
Merrill, John Walcott, IV, Tewksbury, Mass.	————
Miller, Alex Michael, VI, Perth Amboy, N. J.	392 Chelmsford Street
Morton, Jackson Wentworth, IV, Jamaica Plain, Mass.	————
Perry, Walter Holden, IV, North Andover, Mass.	————
Petersen, Richard Edward, IV, Concord, Mass.	————
Porter, Robert Ellis, VI, Ware, Mass.	479 Westford Street
Queeney, John Hart, VI, Scituate, Mass.	406 Pawtucket Street
Riordan, Pauline Frances, IV, Lowell, Mass.	21 Orchard Street
Rosenbaum, Joseph Hans, IV, Lowell, Mass.	66 Princeton Boulevard
Sargent, Ann Eileen, IV, Lowell, Mass.	24 Maude Street
Yanes, Arthur Selig, VI, Brookline, Mass.	479 Westford Street

Class of 1948

Bardzik, John Walter, IV, Dracut, Mass.	————
Bianco, Albert Lawrence, IV, East Paterson, N. J.	21 Dunbar Avenue
Bisko, Stephen John, VI, Dorchester, Mass.	406 Pawtucket Street
Boule, Wilfred Leo, IV, Lowell, Mass.	66 Mt. Hope Street
Clogston, Samuel Leighton, VI, Lowell, Mass.	152 Wentworth Avenue
Fain, Samuel Zachary, VI, New York, New York	392 Chelmsford Street
Farren, Roger Patrick, IV, Medford, Mass.	————
Frank, Allen Morris, IV, Lowell, Mass.	25 Canton Street
Giffler, Bernard, VI, Brooklyn, N. Y.	260 Middlesex Street
Glade, Nathaniel Henry, IV, Fall River, Mass.	66 Lane Street
Grime, Norman Brown, VI, Swansea, Mass.	No. Tewksbury
Hagerty, Francis William, VI, Lexington, Mass.	————
Helland, Howard Manley, VI, Whitinsville, Mass.	11 White Street
Hirn, John Edward, Jr., IV, E. Hartford, Conn.	364 Beacon Street
Hoyle, Albert Gerard, IV, Lowell, Mass.	128 Mt. Hope Street
Kavouras, Christos Nikitas, VI, Lowell, Mass.	5 Hancock Avenue
King, James Robert, VI, Lowell, Mass.	158 Howard Street
Landry, Charles Joseph, VI, Lowell, Mass.	348 Hildreth Street
Leitch, John Badger, VI, Andover, Mass.	————
Levin, Jordan, VI, Lowell, Mass.	141 East Merrimack Street
Lima, Manuel Flores, VI, Cuidad Mendoza, Veracruz, Mexico	8 Mt. Washington Street
Lipper, Berthold, IV, Forest Hills, N. Y.	123 Riverside Street
McKittrick, Vernon Russell, VI, Lowell, Mass.	10 Belmont Street
McKniff, John Thomas, IV, Forge Village, Mass.	————
McKone, Peter Joseph, Jr., IV, Lowell, Mass.	29 Orleans Street
McNally, Alan Martin, IV, Dracut, Mass.	————
Meister, Robert Benjamin, IV, Maynard, Mass.	100 Mt. Washington Street
Morel, Gerard Charles, IV, Andover, Mass.	62 Colonial Avenue
Morris, Donna Louise, IV, Lowell, Mass.	40 Livingston Avenue
Murphy, George Campbell, IV, Buffalo, N. Y.	406 Pawtucket Avenue
O'Donnell, James Francis, IV, No. Chelmsford, Mass.	————
O'Flahavan, James Michael, IV, Lowell, Mass.	62 Colonial Avenue
Penner, Stuart Emanuel, IV, Lawrence, N. Y.	53 Nesmith Street

Home Address	*Lowell Address*
Reynolds, James Michael, IV, Lowell, Mass.	3 Concord Place
Roughan, John Michael, IV, Lowell, Mass.	176 Andover Street
Shann, William Edwin, VI, Andover, Mass.	————
Siegel, Melvin, VI, New York, N. Y.	77 Mt. Washington Street
Simon, Richard Bernard, IV, New York, N. Y.	23 Kearsage Street, Dracut
Smoler, Irwin Charles, VI, New York, N. Y.	77 Livingston Avenue
Spofford, Ray Milton, VI, Haverhill, Mass.	————
Wall, James Thomas, VI, Lowell, Mass.	157 Pleasant Street
Werkowski, Stanley Joseph, VI, Lowell, Mass.	175 Fort Hill Avenue
Wielicka, Edward Dominic, IV, Lawrence, Mass.	————
Wilkinson, Mary Ruth, IV, North Andover, Mass.	————
Wilkinson, Vernon Lee, VI, Lawrence, Mass.	————

Class of 1949

Affler, Manuel, VI, Montreal, Que.	77 Livingston Avenue
Alden, John, VI, Lowell, Mass.	45 Harvard Street
Amado, Luciano Solveira, VI, Rio de Janeiro, Brazil	15 Douglas Road
Aslanoglou, George Leonidas, VI, Athens, Greece	43 Plymouth Street
Beckenstein, Leonard, VI, Brooklyn, N. Y.	77 Livingston Avenue
Bess, Leon, V, Paterson, N. J.	42 South Walker Street
Bill, Walter Edgar, IV, Lowell, Mass.	64 Foster Street
Blackman, Harvey Bernard, VI, Brockton, Mass.	25 Princeton Blvd.
Braff, Stanford Wolf, VI, Brooklyn, N. Y.	392 Chelmsford Street
Brassil, Robert Daniel, IV, Lowell, Mass.	404 Wentworth Avenue
Britton, Edward Joseph, IV, Lowell, Mass.	47 Lundberg Street
Brown, Russell Lee, Jr., VI, Lowell, Mass.	59 Bradstreet Avenue
Callahan, Daniel Francis, IV, Lowell, Mass.	26 Second Avenue
Carpenter, Bryant Locke, VI, Rockland, Mass.	47 Forest Street
Chan, Ping-Chao, VI, Kumming, China	43 Plymouth Street
Charatz, Milton, IV, Brooklyn, N. Y.	77 Livingston Avenue
Cherowbrier, Edward, Jr., IV, Methuen, Mass.	————
Coffey, John Francis, VI, Lowell, Mass.	799 Merrimac Street
Colman, Alexander Herman, VI, New York, N. Y.	77 Livingston Avenue
Conlon, William Henry, IV, Lowell, Mass.	101 Walker Street
Daroowalla, Aspi D., V, Ahmedabad, India	55 Huntington Street
Davis, James Edward, VI, Toronto, Ontario	51 Orchard Street
DeAngelis, Louis Paul, VI, Old Forge, Pa.	100 Mt. Washington Street
Deirmentzoglou, Costas Anast, VI, New Smyrna, Greece	43 Plymouth Street
DeMallie, Stephen Potter, VI, Lowell, Mass.	275 Gibson Street
Derby, James Henry, IV, Lawrence, Mass.	————
Dougherty, Wilbur Edgehill, VI, Lowell, Mass.	131 Upham Street
Downing, Parker Willard, IV, Ayer, Mass.	————
Duffy, Joseph Gordon, VI, Lawrence, Mass.	————
Dulack, Joseph Thomas, Jr., VI, Somersville, Conn.	439 Varnum Avenue
Dulken, John Frederick, VI, Montclair, N. J.	417 Wilder Street
Eliyesil, Mehmed Can, VI, Tarsus, Turkey	123 Riverside Street
Feltheimer, Arthur Murray, VI, Bronx, N. Y.	77 Livingston Avenue
Field, Marvin Joseph, VI, Bronx, N. Y.	123 Riverside Street
Fishman, Maurice, IV, Roxbury, Mass.	91 Methuen Street
Foley, William Mathew, IV, Lowell, Mass.	120 Fulton Street
Fox, Richard Coleman, VI, Lowell, Mass.	27 Royal Street
Fraser, Richard Warren, VI, Melrose, Mass.	43 Plymouth Street

Home Address	*Lowell Address*
Friedlander, Robert, VI, Brooklyn, N. Y.	39 West Street
Fruchtman, Gerald Gary, VI, Brooklyn, N. Y.	9 Dunbar Avenue
Gardner, Lawrence Carroll, IV, Lowell, Mass.	48 Sutherland Street
Giglio, Frank Antonio, VI, Brooklyn, N. Y.	9 Dunbar Avenue
Gilchrest, Dexter Stuart, VI, Beverly, Mass.	———
Glasheen, Richard Welch, IV, Lowell, Mass.	272 Merrimack Street
Glickman, Daniel, IV, Brookline, Mass.	42 South Walker Street
Godet, John Russell, IV, Lowell, Mass.	71 Agawam Street
Gordon, David Albert, IV, Paterson, N. J.	173 Branch Street
Gottlieb, Seymour, VI, Brooklyn, N. Y.	59 Arlington Street
Greenberg, Bernard, VI, Brooklyn, N. Y.	77 Livingston Avenue
Greene, Philip Leon, VI, Brooklyn, N. Y.	61 Twelfth Street
Gregg, Julian Barnes, VI, Worcester, Mass.	406 Pawtucket Street
Gruber, Phillip Arthur, IV, Lowell, Mass.	57 Corbett Street
Guggenheim, Leopoldo Levi, VI, Santiago, Chile	15 Douglas Road
Gunther, Marilyn Katherine, IV, Dracut, Mass.	———
Hallett, Richard Libby, VI, Lowell, Mass.	98 Wannalancit Street
Handy, William LaFayette, VI, Longmeadow, Mass.	53 Mount Hope Street
Harvey, Clifford Arthur, IV, Lowell, Mass.	36 Woodward Terrace
Haskel, Simon Aaron, VI, Brooklyn, N. Y.	77 Livingston Avenue
Horwitz, Edward Melvin, VI, Utica, N. Y.	392 Chelmsford Street
Howland, Henry Talmadge, VI, Skaneateles, N.Y.	457 Westford Street
Huff, Thomas Augustus, VI, West Coast, B. C.	406 Pawtucket Street
Illingworth, Sam Groveham, V, West Newton, Mass.	———
Kane, James Francis, VI, Lowell, Mass.	37 Unsworth Street
Kaufman, David Leonard, VI, Denver, Colo.	100 Mt. Washington St.
Keeney, John Henry, VI, Somersville, Conn.	137 Riverside Street
Kennedy, James Harrington, III, VI, Lowell, Mass.	43 Florence Avenue
Kenniston, George Demeritt, IV, Lowell, Mass.	67 Loring Street
King, John Michael, Jr., VI, Lowell, Mass.	158 Howard Street
Koksal, Lutfi, VI, Istanbul, Turkey	29 Burtt Street
Kosartes, Marina, VI, Lowell, Mass.	1036 Middlesex Street
Krivis, Ernest, VI, Los Angeles, Calif.	260 Aspinwall Avenue, Brookline
Lachut, Herbert Michael, IV, Dracut, Mass.	———
Lapidus, Charles Henry, IV, Brooklyn, N. Y.	77 Livingston Avenue
Lash, Seymour Lech, VI, New York, N. Y.	61 Twelfth Street
Lent, Roy Gordon, VI, Maynard, Mass.	9 Dunbar Avenue
Lesser, Stanley Baker, VI, Brooklyn, N. Y.	239 Stevens Street
Levine, Julius, VI, New York, N. Y.	77 Livingston Avenue
Liverant, Manfred, VI, Montreal, Canada	2 Bellevue Street
Lord, Edwin Lincoln, Jr., VI, W. Medford, Mass.	457 Westford Street
Luz, Victor James, VI, Lowell, Mass.	1122 Gorham Street
McCartin, John Peter, VI, Lowell, Mass.	611 Stevens Street
McHugh, Thomas Francis, VI, Fitchburg, Mass.	37 Varney Street
McMahon, Laurence Francis, IV, Lowell, Mass.	7 Belmont Street
Maguire, John Paul, VI, Lowell, Mass.	31 Prospect Street
Manning, Edward Nicholas, IV, Cambridge, Mass.	84 Methuen Street
Martin, James Francis, VI, Lowell, Mass.	53 Fay Street
Mitchell, Alvin Emery, IV, Warwick, R. I.	272 Merrimack Street
Na, Chung-Sheng, IV, Kumming, China	43 Plymouth Street
Nanda, Dharampal Amarnath, VI, Bombay, India	25 Varney Street
Natter, Sidney, VI, Bronx, N. Y.	76 Royal Street

Home Address	Lowell Address
NICKERSON, HOWARD LESLIE, JR., IV, Chelmsford, Mass.	———
O'TOOLE, MARTIN JOSEPH, VI, Brighton, Mass.	11 White Street
PEIRENT, ROBERT JOHN, IV, Dracut, Mass.	———
PFISTER, DAVID HERBERT, V, Lynbrook, N. Y.	137 Riverside Street
PIEKARSKI, WILLIAM FABIAN, IV, Lowell, Mass.	179 Hildreth Street
PINTO, AMERICO SEABRA MOURA, VI, Rio de Janeiro, Brazil	20 Mansur Street
POLEBAUM, EUGENE HARVEY, VI, Brooklyn, N. Y.	52 Princeton Blvd.
REIMER, MORTON STERLING, VI, North Adams, Mass.	406 Pawtucket Street
RENAUX, INGO ARLINDO, VI, Brusque, Brazil	8 Mount Washington Street
RHODES, MAX, IV, Queens, N. Y.	77 Livingston Avenue
RICHARDSON, DONALD FORREST, VI, Lowell, Mass.	798 Moody Street
RIORDAN, WARREN PAUL, JR., VI, Lowell, Mass.	21 Orchard Street
ROSA, MANUEL AUGUST, VI, Methuen, Mass.	———
ROY, RAYMOND EMILE, IV, Lowell, Mass.	95 Jenness Street
SAYERS, THOMAS MARTIN, VI, Lowell, Mass.	27 Burtt Street
SCHWARZ, WALTER, VI, Elmhurst, N. Y.	118 Mt. Washington Street
SEGALL, WILLIAM MARTIN, IV, Lowell, Mass.	111 Luce Street
SHAPIRO, HERMAN, IV, Chelsea, Mass.	———
SHAPIRO, SUMNER, VI, Lowell, Mass.	37 Canton Street
SHAUGHNESSY, JOHN ANDREW, IV, Lowell, Mass.	18 Puffer Street
SHEEHAN, CHARLES RUSSELL, IV, Lowell, Mass.	374 Adams Street
SOKOLOFF, JOSEPH, VI, Brooklyn, N. Y.	77 Livingston Avenue
SQUIRE, CHARLES, VI, West New York, N. J.	137 Riverside Street
STRAVRAKAS, EVANGELOS, V, Brooklyn, N. Y.	215 Mammoth Road
STILLMAN, EDWARD ISAAC, VI, Shaker Heights, Ohio	896 Moody Street
STRATTON, CLIFFORD GARNET, VI, Lowell, Mass.	272 Merrimack Street
STROBEL, RICHARD IRVING, IV, Lawrence, Mass.	———
STROUP, JOHN FRANCIS, JR., IV, Dorchester, Mass.	406 Pawtucket Street
SUGG, PHILIP WILLSON, VI, Lisbon Falls, Me.	406 Pawtucket Street
SULLIVAN, JOHN EDWARD, VI, Lowell, Mass.	280 Beacon Street
SUMAR, CESAR PACHA, IV, Santiago de Chile, Chile	392 Chelmsford Street
SWEENEY, JAMES WILLIAM, IV, Lowell, Mass.	318 Adams Street
TROMMER, CHARLES RICHARD, IV, New York, N. Y.	392 Chelmsford Street
VOLIN, IRWIN JACK, VI, Lawrence, N. Y.	53 Nesmith Street
VOMVOURAS, PAUL, VI, Boston, Mass.	406 Pawtucket Street
WEINSTEIN, MANUEL, VI, Revere, Mass.	43 Plymouth Street
WEISER, JOHN BENNO, VI, Elmhurst, N. Y.	8 Bagley Avenue
WEISS, DONALD STUART, V, Bronx, N. Y.	25 Princeton Blvd.
WHITEHEAD, CHARLES ANDREW, V, Dover, N. J.	215 Mammoth Road
WILBUR, EARL RAYMOND, IV, Lowell, Mass.	172 Shaw Street
WOODWARD, PAUL HENRY, VI, Lebanon, N. H.	392 Chelmsford Street
YOUNG, WILLIAM ARTHUR, VI, Toronto, Canada	476 Varnum Avenue
YUMLU, MUSTAFA EKREM, VI, Istanbul, Turkey	441 Westford Street

CLASS OF 1950

ABBATINOZZI, CARL MARIO, VI, Everett, Mass.	———
ABBOTT, GEORGE AMOS, II, Malden, Mass.	466 Bridge Street
ADLER, KENNETH MYRON, VI, Brooklyn, N. Y.	306 Wilder Street
ALLY, ROGER EDWARD, VI, Lowell, Mass.	Fanning Street
ANDREWS, HUGH HILL, VI, Andover, Mass.	———
ANGELO, PAUL JOSEPH, JR., VI, Lowell, Mass.	55 Belrose Avenue
ANTHONY, ROBERT MANNING, IV, Lowell, Mass.	20 Loring Street
ATHAS, STANLEY THEODORE, VI, Lowell, Mass.	138 Bowers Street

Home Address	Lowell Address
Augsberger, Gerardo Rainer, V, Buenos Aires, Argentina	59 Arlington Street
Baird, Gerald Robert, VI, North Adams, Mass.	23 Huntington Street
Barnes, Parker Loring, II, Plymouth, Mass.	227 Nesmith Street
Becker, Richard John, VI, Lowell, Mass.	34 Crowley Street
Benander, Carl Vincent Milton, V, Plainville, Mass.	1282 Bridge Street
Berandina, Nicholas, IV, Everett, Mass.	54 Fourth Avenue
Besso, Michael Maurice, IV, Brooklyn, N. Y.	109 Mammoth Road
Blagman, Burton, IV, Brooklyn, N. Y.	77 Livingston Avenue
Bonczar, Thaddeus Joseph, VI, Lowell, Mass.	130 Jewett Street
Book, Bernard Samuel, VI, Bronx, N. Y.	263 Princeton Blvd.
Boudreau, Paul Victor, IV, Lowell, Mass.	295 Riverside Street
Bowden, Alanson Walker, Jr., II, Bethel, Me.	1396 Bridge Street, Dracut
Breck, Wendell Herbert, II, Dracut, Mass.	———
Brennan, Thomas William, Jr., II, Flushing, N. Y.	53 Mt. Hope Street
Bressler, Sidney Wallace, VI, Brockton, Mass.	52 Princeton Blvd.
Brickley, Thomas Raymond, IV, Everett, Mass.	———
Brown, Judith Anne, IV, Georgetown, Mass.	John Street
Brown, Walter Madison, II, Worcester, Mass.	34 Arlington Street
Bruce, Dennis William, IV, Westmount, Canada	59 Crescent Street
Brunelle, Norman Mathew, IV, Fitchburg, Mass.	298 Riverside Street
Burns, Edward Charles, IV, Lowell, Mass.	511 Westford Street
Burns, James Rudolph, VI, Arlington, Mass.	———
Bussiere, Robert William, III, Pittsfield, Mass.	143 Upham Street
Callan, Stephen Smith, VI, Reading, Mass.	———
Canino, Vincent Dante, IV, Wakefield, Mass.	———
Canova, Alfred William, VI, Holyoke, Mass.	374 Walker Street
Carbone, Theodore August, IV, Haverhill, Mass.	———
Carnevale, John Ralph, IV, Lowell, Mass.	62 West Fifth Avenue
Carter, Fred Dolge, VI, Millbury, Mass.	———
Casey, John Gerard, VI, Pittsfield, Mass.	418 Walker Street
Casey, Thomas Garrett, IV, Lowell, Mass.	8 Gates Street
Chadwick, Thomas Neilson, VI, Lowell, Mass.	57 Robbins Street
Cherenson, Lee Edward, VI, Lowell, Mass.	71 Canton Street
Chertavian, Armen, IV, Lowell, Mass.	135 Beacon Street
Clifford, Stanley Joseph, VI, West Roxbury, Mass.	234 Parker Street
Cohen, Stanley Robert, V, Mattapan, Mass.	32 Orchard Street
Commerford, Therese Rita, IV, Lowell, Mass.	29 Starbird Street
Copp, Albert Raymond, IV, Hudson, Mass.	28 Riverside Street
Cummings, Robert Edward, VI, Enfield, Conn.	5 White Street
Douglas, Warren Dana, VI, Lowell, Mass.	30 Burgess Street
Driscoll, George Alphonsus, VI, Brighton, Mass.	19 Eighth Street
Dziedzina, Frank, IV, Lowell, Mass.	41 Wachusett Street
Earls, Robert Kimball, VI, Southbridge, Mass.	956 Lakeview Avenue
Eaton, Curtis Abbot, VI, Wakefield, R. I.	661 Rogers Street
Ellis, Lawrence Francis, II, Melrose, Mass.	207 Mammoth Road
Evangelos, Nicholas Joseph, IV, North Andover, Mass.	———
Evans, John, IV, East Boston, Mass.	1088 Bridge Street
Evans, William George, IV, East Boston, Mass.	1088 Bridge Street
Farley, Glenn Robert, VI, North Andover, Mass.	———
Feldman, Manuel David, V, Lynn, Mass.	236 Branch Street
Feyler, Donald Pearson, IV, Chelmsford, Mass.	———
Feyler, Irving Wyman, Jr., IV, Chelmsford, Mass.	———

Home Address	*Lowell Address*
Fifield, Richard Tyler, VI, Melrose, Mass.	———
Fishback, Joseph, IV, Rockaway Beach, N. Y.	77 Livingston Avenue
Flister, Walter Edwin, IV, Hyde Park, Mass.	230 Riverside Street
Fowle, Frederick Jordan, VI, Wellesley, Mass.	623 Andover Street
Fox, Julius Ira, VI, Philadelphia, Pa.	418 Westford Street
Gaidis, Leo Peter, IV, Lawrence, Mass.	———
Genest, Albert Arthur, VI, Lowell, Mass.	638 Market Street
Genest, Leon Henry, VI, Lowell, Mass.	38 Ellis Avenue
Gertz, Morris, VI, Brooklyn, N. Y.	299 Princeton Blvd.
Gillick, William Leo, IV, Lowell, Mass.	47 S. Walker Street
Glass, Arthur Marvin, V, Providence, R. I.	777 Merrimack Street
Glen, Marshall David, VI, Brookline, Mass.	241 Liberty Street
Goldman, Alfred Yale, V, Dorchester, Mass.	777 Merrimack Street
Goldman, Sumner Bernard, VI, Roxbury, Mass.	14 Oakland Road
Goldstein, Morton Irwin, V, Springfield, Mass.	42 S. Walker Street
Gouveia, Adelino Peter, IV, Lowell, Mass.	161 Lawrence Street
Gregg, Joan Louise, IV, Lowell, Mass.	1867 Middlesex Street
Grochmal, Stanley Joseph, IV, Lowell, Mass.	46 Albion Street
Hacker, Morton, VI, Lowell, Mass.	7 Rockdale Avenue
Hahn, Lester, III, Dorchester, Mass.	418 Westford Street
Halpin, John Thomas, Jr., IV, Lowell, Mass.	105 Walker Street
Hathorne, Berkley Charles, VI, Waltham, Mass.	———
Hekker, Frank Henry, IV, Rutherford, N. J.	406 Pawtucket Street
Herbert, Erwin Lori, VI, Elizabeth, N. J.	272 Merrimack Street
Higgins, William Eugene, VI, Lowell, Mass.	197 Moore Street
Hitchcock, Ralph William, II, Waltham, Mass.	114 Wilder Street
Hornyak, Frederick Mathew, IV, Philadelphia, Pa.	155 Pleasant Street, Dracut
Hoyt, Alden Samuel, IV, Lowell, Mass.	100 Hayes Avenue
Huidekoper, Peter Galloway, VI, Washington, D. C.	15 Douglas Road
Jewett, Frederic Darwin, Jr., VI, Allenton, Mass.	44 Harvard Street
Kavanagh, William Joseph, VI, Forge Village, Mass.	———
Kelly, John Richard, VI, Lowell, Mass.	53 S. Walker Street
Kenney, Francis Jerome, IV, Lowell, Mass.	71 Harland Avenue
King, Richard McClain, VI, Shawnee, Okla.	5 White Street
Koffman, Leonard Saunders, VI, Roxbury, Mass.	21 Arlington Street, Dracut
Kormos, Peter Marion, VI, Lowell, Mass.	268 East Merrimack Street
Koshak, Daniel, IV, Brooklyn, New York	240 West Sixth Street
Lafford, Gilbert Roderick, Jr., IV, Gloucester, Mass.	777 Merrimack Street
Lanford, Cecil Belton, VI, New Haven, Conn.	72 Varney Street
Laureti, Remo Joseph, VI, Quincy, Mass.	457 Westford Street
Lebowitz, Myer, VI, Boston, Mass.	457 Westford Street
Leitgeb, Donald Joseph, V, Waldwick, N. J.	284 Wilder Street
Lemire, Gabrielle Marie, IV, Lowell, Mass.	52 Colonial Avenue
Leskanic, Stephen Daniel, IV, Rochelle Park, N.J.	155 Pleasant Avenue, Dracut
Levine, Morton Jay, VI, Norwich, Conn.	77 Livingston Avenue
Liberty, William Wallace, VI, Quechee, Vt.	44 Harvard Street
Lorberbaum, Alan Seymour, VI, New York, N. Y.	606 Westford Street
Lynch, Robert Charles, IV, Lynn, Mass.	90 Dover Street
McCarron, Dorothy Anne, IV, Lowell, Mass.	416 Rogers Street
McGowan, Malcolm, IV, Lowell, Mass.	262 Shaw Street
McHugh, Peter Joseph, VI, Chelmsford, Mass.	———

Home Address	Lowell Address
Macuga, Francis Robert, VI, East Douglas, Mass.	406 Pawtucket Street
Mahoney, Herbert Francis, IV, Winchester, Mass.	66 Riverside Street
Majeune, Gaston Christian, IV, Haverhill, Mass.	———
March, Peyton Conway, VI, Melrose, Mass.	451 Westford Street
Mark, Regina, V, Baltimore, Md.	50 John Street
Meltzer, Richard Morris, VI, New York, N. Y.	244 Parker Street
Merrill, Allen Robert, VI, Tewksbury, Mass.	———
Middleton, Donald Whiting, VI, Rehoboth, Mass.	12 Crawford Street
Miller, James Edward, IV, Leavenworth, Kansas	12 Crawford Street
Morrison, Robert Eugene, IV, Dracut, Mass.	———
Newman, Jerome Leonard, VI, Brooklyn, N. Y.	32 Dover Street
O'Connor, James Roderick, IV, Lowell, Mass.	29 Bertha Street
O'Donoghue, John Francis, VI, Belmont, Mass.	———
O'Krafka, Alfred Ernest, VI, Hespeler, Ontario	75 Smith Street
Palmer, James Wesley, VI, Clarendon, Texas	1088 Bridge Street
Parent, Gerald Donald, VI, Lowell, Mass.	1 Dracut Street
Paul, Vito John, VI, Lawrence, Mass.	———
Peterson, John Samuel, VI, Andover, Mass.	———
Plein, Thomas Leo, VI, E. Chelmsford, Mass.	———
Poremba, Henry Edward, V, Lowell, Mass.	579 Lawrence Street
Powers, Frank Edward, Jr., VI, Uxbridge, Mass.	53 Mt. Hope Street
Priestley, Joseph Amos, VI, Lowell, Mass.	511 Bridge Street
Profio, Samuel Camillo, IV, Lowell, Mass.	1878 Middlesex Street
Proulx, Raymond Elphege, VI, Lowell, Mass.	17 Dodge Street
Ramsbottom, John Dana, Jr., VI, Fall River, Mass.	406 Pawtucket Street
Rawitz, Leonard, VI, Roxbury, Mass.	21 Arlington Street, Dracut
Rebenfield, Ludwig, IV, Jackson Heights, N. Y.	263 Princeton Blvd.
Reines, William, IV, Poughkeepsie, N. Y.	25 Canton Street
Ringanese, Michael Jerry, VI, Dalton, Mass.	418 Walker Street
Rivollier, Elie, V, Clinton, Mass.	441 Westford Street
Rodgers, Charles Joseph, Jr., IV, Lowell, Mass.	14 Du Merle Street
Rudes, Sidney, VI, Brooklyn, N. Y.	77 Livingston Avenue
Rudolf, Mitchell Joseph, VI, Lowell, Mass.	5 Hazel Square
Ruffenach, Stephen Clifford, IV, Paterson, N. J.	78 Whitney Avenue
Russell, Earl David, VI, Chelmsford, Mass.	———
Samdperil, Albert, VI, Providence, R. I.	241 White Street
Sampson, Walter Stewart, Jr., VI, Belmont, Mass.	———
Scanlon, Timothy Patrick, IV, Lawrence, Mass.	———
Shea, John Joseph, VI, Southbridge, Mass.	272 Merrimack Street
Sherman, Edward Bernard, VI, Worcester, Mass.	32 Orchard Street
Shires, William Stanley, VI, Lowell, Mass.	9 Burns Street
Sloan, Robert Hood, VI, Tewksbury, Mass.	———
Smaha, Herbert Joseph, IV, Methuen, Mass.	———
Sorkin, Saul, VI, Brooklyn, N. Y.	37 Ware Street
Soutter, Elinor Pauline, IV, Lowell, Mass.	191 Parkview Avenue
Spencer, Robert Weeks, VI, Saylesville, R. I.	37 Varney Street
Spicer, George William, IV, Lowell, Mass.	19 Rhodora Street
Strickland, Robert Albert, IV, No. Andover, Mass.	———
Swanson, Paul Kimball, VI, Chelmsford, Mass.	———
Taylor, Paul Francis, IV, Lowell, Mass.	531 Fletcher Street
Teubal, Michael Neville, VI, Buenos Aires, Argentina	222 Varnum Avenue
Twardzik, Eugene Michael, VI, Tribes Hill, N.Y.	74 Huntington Street
Webster, Charles Clifford, VI, Lowell, Mass.	225 Foster Street
Welcome, William Francis, IV, Lowell, Mass.	105 Lauriat Street

Home Address	*Lowell Address*
West, Albert George, VI, Whitinsville, Mass.	418 Walker Street
Wilkinson, John Stewart, VI, North Andover, Mass.	————
Wirth, Allan Robert, IV, Lawrence, Mass.	————
Woidzik, Albert Thomas, VI, Pringle, Pa.	59 Crescent Street
Wojcik, Charles Alexander, VI, Lowell, Mass.	42 West Fifth Street

DIPLOMA STUDENTS

Class of 1947

Dolge, David Bigelow, II, Hazardville, Conn.	East Street, Tewksbury
Nalbandian, Archavir, I, Santiago, Chile	392 Chelmsford Street
Pettengill, Warren Martin, II, Lowell, Mass.	26 Huntington Street

Class of 1948

Bates, William Charles, II, Neepawa, Can.	392 Chelmsford Street
Boulay, Alice Elizabeth, III, Dracut, Mass.	————
Burns, Robert William, II, Whitefield, N. H.	19 Waverly Street
Conlon, William Joseph, II, Lawrence, Mass.	————
Dinan, Robert Joseph, II, Nashua, N. H.	————
Fanning, Leo Francis, II, Moosup, Conn.	298 Riverside Street
Fieldsend, George Tom, II, Hudson, Mass.	30 Riverside Street
Johnson, William Warren, I, Short Hills, N. J.	215 Mammoth Road
Jones, Richard Bradley, II, Hingham, Mass.	84 Methuen Street
Kent, Ferrell George, I, Melrose, Mass.	————
McCord, Douglas Duncan, III, Outremont, Que.	37 Varney Street
Mathieu, Robert Charles, II, Woonsocket, R. I.	5 White Street
Mendrala, Edward John, II, Thompsonville, Conn.	305 Nesmith Street
Merrill, Richard Douglas, I, Chelmsford, Mass.	————
Poblocki, Raymond Robert, II, Webster, Mass.	5 White Street
Rosenthal, Theodore Alton, II, Waterville, Me.	84 Methuen Street
Rothman, Alvin, II, Brooklyn, N. Y.	52 Princeton Blvd.
Rubenstein, Stanley, III, Brooklyn, N. Y.	50 Third Avenue
Schwartz, Marvin Norman, II, Brooklyn, N. Y.	77 Livingston Avenue
Sweeney, Dennis John, II, Brockton, Mass.	92 W. Chestnut Street
Vallincour, Dorothy Jeannette, III, Lowell Mass.	59 Foster Street
Whittier, Nathaniel True, III, Milton, Mass.	77 Mt. Washington Street

Specials

Buerhaus, Robert Bronsdon, II, Needham, Mass.	406 Pawtucket Street
Burgess, Phillip Bradford, IV, Grafton, Mass.	209 Nesmith Street
Campbell, Andrew Morris, IV, Andover, Mass.	————
Cohen, Sumner Alvin, II, Brookline, Mass.	————
Curry, Thomas Edward, II, East Greenwich, R. I.	406 Pawtucket Street
Dickey, Harry Stanley, Jr., II, Baltimore, Md.	Main Street, Tewksbury
Dunn, Norbert John, II, Thompsonville, Conn.	9 Dunbar Avenue
Eisenwinter, Lemuel Whitney, I, Watertown, Conn.	29 Kirk Street
Grover, Marvin, VI, Montreal, Canada	77 Livingston Avenue

Home Address	Lowell Address
Guise, Francisco Jose de Souza, I, Rio de Janeiro, Brazil	54 Pentucket Avenue
Harrison, Robert Arthur, I, Brookline, Mass.	———
Johnson, James William, VI, Forest Hills, N. Y.	Graniteville Road, No. Chelmsford
Jones, Newton Browder, II, Sweetwater, Tenn.	4 Stratford Road, Andover
Kisielewski, Joseph Louis, II, Webster, Mass.	272 Merrimack Street
Lasar, Lionel, II, Brooklyn, N. Y.	———
Little, Charles Nelson, II, Utica, N. Y.	55 Huntington Street
Liu, Han Tang, VI, Shanghai, China	12 Warwick Street
Lopez, Francisco Rizal, VI, Manila, Philippines	26 Crawford Street
McGuire, David Lewis, II, New London, Conn.	———
Mallon, John Francis, IV, Lawrence, Mass.	———
Moseley, George Kenneth, II, Mamoroneck, N. Y.	Main Street, Tewksbury
Murray, Ardelle May, III, Lowell, Mass.	1535 Middlesex Street
Norris, Frank Thomas, IV, Holyoke, Mass.	9 White Street
Pajak, Edward George, I, Ware, Mass.	272 Merrimack Street
Peterson, Mendel Lazear, VI, Brookhaven, Miss.	582 Westford Street
Rugen, Richard Longstreet, II, Stafford Springs, Conn.	39 Milton Street, Lawrence
Segal, Herbert Hinsch, III, Brookline, Mass.	37 Varney Street
Shroff, Bharat Chimanlal, III, Bombay, India	37 Varney Street
Simon, Alfred Mason, II, W. Newton, Mass.	———
Simon, Stanley Rissman, VI, Chicago, Ill.	77 Livingston Avenue
Sullivan, Charles Francis, II, Lowell, Mass.	27 Emery Street
Sullivan, John Francis, II, Belmont, Mass.	———
Tenney, Ashton Melville, Jr., VI, No. Chelmsford, Mass.	———
Teres, Howard Fred, I, New York, N. Y.	392 Chelmsford Street
Viau, George Orlando, VI, Lowell, Mass.	12 Whitney Avenue
Whitman, Hendricks Hallett, Jr., II, Boston, Mass.	50 Standish Street
Wornom, Lawrence Dale, VI, Chandler, Okla.	6 Beech Street, No. Chelmsford

SERIES 50, NO. 1
CURRICULUM BULLETIN

August, 1947

LOWELL EVENING TEXTILE SCHOOL

LOWELL, MASS.

1947-1948

Entered August 26, 1902, at Lowell, Mass., as second-class matter
under act of Congress of July 16, 1894

Textile and Colonial Avenue

A DEPARTMENT OF
LOWELL TEXTILE INSTITUTE

Publication of this Document Approved by the Commission on Administration and Finance

4m-7-47-21587

TRUSTEES OF THE LOWELL TEXTILE INSTITUTE

CALENDAR—1947

September 23, Tuesday	Registration
September 30, Tuesday	Registration
October 6, Monday	Opening of Evening School
October 13, Monday	Columbus Day—Holiday
November 11, Tuesday	Armistice Day—Holiday
November 19-20 Wednesday and Thursday	Thanksgiving Recess
December 18, Thursday, 9 P.M.	Christmas recess begins

1948

January 5, Monday, 6 P.M.	Christmas recess ends
February 23, Monday	Washington's Birthday—Holiday
March 4, Thursday	Closing of Evening School

GENERAL INFORMATION

Entrance Requirements

Entrance requirements cary with the course or subject selected. For subjects taken toward a certificate, the requirement, in general, is graduation from grammar school or presentation of equivalent education. For those students desiring to obtain a diploma from the Lowell Evening Textile School, the requirement is graduation from a recognized high school or presentation of equivalent study or achievement.

Evidence of equivalent education, in place of grammar or high school graduation may be given by taking an examination, usually on registration evenings, or by presenting records of various courses taken elsewhere. Those who are not high school graduates but wish to work toward a diploma may satisfy the requirement by taking evening courses at the Textile School, consisting usually of Mathematics, English, Physics and Chemistry.

Registration

Students must register by filling out the necessary forms and paying fees, before attending classes. Registration is held on the dates indicated in the calendar above or on the opening nights of the various classes. Much time will be saved by registering in advance.

Sessions

Classes are held on Monday, Tuesday, Wednesday and Thursday evenings each week, usually from 7 to 9 P.M., although other hours are sometimes required in particular subjects. The subjects offered require from one evening per week to three evenings per week. (See subject schedules).

The scheduled nights for the various subjects in the following pages are tentative and may be altered in a few cases.

Fees and Deposits

Tuition for all evening courses is free to residents of Lowell, provided a certificate of residence is filed with the school office. Such certificates may be obtained from the Election Commission, City Hall, Lowell.

To non-residents the tuition fees are as follows:

One evening per week courses	$ 5.
Two evenings per week courses	$10.
Three evenings per week courses	$15.

Students electing any chemistry course must make a laboratory deposit of $10. Those electing Machine Shop Practice must make a laboratory deposit of $5. This is to cover supplies and breakage and any unexpended balance at the end of the year will be returned to the student. These laboratory deposit provisions apply to both residents and non-residents of Lowell.

All fees and deposits are payable in advance.

Veterans

All Lowell Evening Textile School courses are approved for study under the G.I. Bill of Rights. Veterans should secure a certificate of eligibility from the Veteran's Administration before registering. A letter from the Veteran's Administration showing application has been made will be accepted for tuition charges but supplies can only be obtained by presentation of the certificate.

Books and Supplies

Students must provide their own books, paper, drawing materials, etc., and pay for any breakage or damage of school equipment that they may cause.

Student supplies will be sold by the school cooperative store each evening school night from 6.45 to 8.15 P.M.

Diplomas and Certificates

Students satisfactorily completing individual courses, ranging in length from one to three years, will be awarded a certificate. (See listing of courses on following pages)

Beginning this year the diploma of the Lowell Evening Textile School will be awarded to students completing a prescribed group of courses, requiring, in general, three nights per week for five or six years. At present diploma courses are being offered in Analytical Chemistry (six years), Textile Chemistry and Dyeing (five years), Textile Chemistry and Tes ting (five years), Cotton Manufacturing (six years), Woolen Manufacturing (five years) and Worsted Manufacturing (six years).

It is planned to offer several other diploma courses next year if the necessary arrangements can be made. Electronics and Textile Styling and Merchandising are among those being considered.

Size of Classes

No first year course will be given unless at least 10 men register for it and in a few instances, more than that number. Advanced courses will usually, but not necessarily, be given, regardless of number.

COTTON DEPARTMENT

Staff

Prof. Gilbert R. Merrill, B.T.E., in charge of department
Asst. Prof. Nathaniel E. Jones
Mr. John A. Goodwin, B.T.E.
Mr. Roger B. Oliver

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Cotton Yarns	101-A	X		X		None
Cotton Yarns	101-B*					101-A
Cotton Yarns	101-C*					101-B
Cotton Yarns	111		X		X	#
Knitting	113		X		X	None
Textile Mechanism & Calculations	601				X	None

* Not offered in 1947-1948

\# In order to include laboratory work, the previous two-year course has been extended to three years. Course 111 is open only to those who previously completed the first year of the old two year course.

Description of the above courses

101-A First year of cotton yarn manufacture. Topics covered include: properties and characteristics of raw cotton, cultivating, ginning and marketing of raw cotton, mixing, opening and picking, carding. Lectures and laboratory.

101-B Second year of cotton yarn manufacture. Topics covered include: combing, drawing, regular and long draft roving. Lecture and laboratory.

101-C Third year of cotton yarn manufacture. Topics covered include: spinning, spooling, winding and twisting. Lecture and laboratory.

111 The second year of the old two-year course in cotton yarn manufacture. Topics include: drawing, roving, spinning, spooling, winding and twisting. Lecture only.

113 A general course in the manufacture of knitted fabrics and garments. It includes yarns and yarn sizing systems, flat machines, small circular ribbers, automatic hosiery machines, large ribbers and spring needle machines, full fashioned machines, warp knitting and knitting design and analysis. Lectures and laboratory demonstration.

601 A short course covering the necessary mechanism, physics, and mathematics required for an understanding of textile machines. In mechanism it covers pulleys, cones, gears, levers, cranks, etc.; in physics it takes up latent heat, vaporization, relative humidity, etc.; in mathematics the topics include constants, square roots, ratio, proportion, formulas, slide rule, etc. It is required for diploma students but is optional, although recommended, for certificate students.

Diploma in Cotton Manufacturing

Beginning this year a diploma in cotton manufacturing will be offered to those completing the courses indicated below. In addition to three years of cotton yarn manufacture (including course 601 in textile mechanism and calculations), the student must take courses in cotton

design, cotton weaving, cotton finishing, textile testing, dyeing, marketing and knitting. Course changes, scheduled for next year (1948-1949), will make it possible to complete this program in about six years if the student attends three nights per week.

This group of courses provides a background in all the basic processes in a cotton mill and is designed for the student who wishes to prepare himself for higher supervisory and executive positions.

Certificates

The certificate of the school will be awarded for completion of the three year course in cotton yarns, 101-A, 101-B, 101-C. Graduates of the old two-year course, 111, will also receive a certificate. The certificate is also awarded in knitting for the completion of 113.

WOOLEN AND WORSTED DEPARTMENT

Staff

Prof. Russell L. Brown, B.T.E., M.S., in charge of department
Asst. Prof. John C. Lowe, B.T.E., M.S.
Asst. Prof. James H. Kennedy, Jr., B.T.E., M.S.
Mr. Henry L. Pero, B.T.E.
Mr. Harold R. Anderson

		EVENINGS				
SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Fiber Preparation	202	X				None
Woolen Yarns	203		X			601
Top Making	204		X			601
Bradford Yarns	205	X				601
French Yarns	206	X	X			601
Textile Mechanism & Calculations	601				X	None

Description of the above courses

202. Types of sheep and wool. Wool grading, sorting, scouring, and carbonizing. Reworked fiber preparation from rags to product. Synthetic fiber staple as rayons, nylon, proteins and plastics. Lecture and laboratory demonstration.

203. Fiber blending, oiling, picking, carding, spinning and twisting into woolen type yarns. Lecture and laboratory demonstration.

204. Worsted carding, backwashing, gilling, Noble and French combing. Specification and analysis for wool and synthetic staple top. Lecture and laboratory demonstration.

205 Worsted drawing, spinning and twisting on English system machinery. Lecture and laboratory demonstration.

206. Worsted drawing, spinning and twisting on French system machinery. Lecture and laboratory demonstration.

601. A short course covering the necessary mechanism, physics and mathematics required for an understanding of textile machines. In mechanism it covers pulleys, cones, gears, levers. cranks, etc.; in physics it takes up latent heat, vaporization, relative humidity, etc.; in mathematics the topics include constants, square roots, ratio, proportion, formulas, slide rule, etc. It is designed to be taken simultaneously with the courses for which it is a prerequisite.

Certificates

The certificate of the school will be awarded for the following group of courses:

Woolen Yarn Certificate— For completion of courses 601, 202, 203. Normally requires one year of three evenings per week.

Bradford Worsted Certificate—For completion of courses 601, 202, 204, 205. Normally requires two years of two evenings per week.

French Worsted Certificate— For completion of courses 601, 202, 204, 206. Normally requires two years, one of three evenings per week and one of two evenings.

Diplomas

Beginning this year diplomas in woolen and worsted manufacture will be awarded to students successfully completing the courses indicated below. These courses will give a background in all the fundamental operations and processes in the respective industries and are designed for the man who wishes to prepare himself for higher supervisory and executive positions.

For a diploma in woolen manufacture the student must complete the woolen yarn certificate course and courses in woolen design, weaving, finishing, textile dyeing, textile testing, knitting and marketing. Course changes, scheduled for next year (1948-1949) will make it possible to complete this program in about five years if the student attends three nights per week.

For a diploma in worsted manufacture the student must complete both Bradford and French worsted yarns and take courses in worsted design, weaving, finishing, dyeing, textile testing and marketing. The course revisions mentioned above should make it possible to complete this program in about six years of three evenings per week.

TEXTILE DESIGN AND WEAVING DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Asst. Prof. Stewart Mackay
Asst. Prof. Martin J. Hoellrich
Asst. Prof. Russell M. Fox
Asst. Prof. John L. Merrill, B.T.E.
Mr. George G. Armstrong
Mr. Edward L. Golec
Mrs. Lucy R. Weinbeck

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Weave Formations & Yarn Calculations	301	X		X		None
Cotton Design	311-A	X		X		301
Cotton Design	311-B		X		X	311-A
Woolen & Worsted Design	312-A	X		X		301
Woolen & Worsted Design	312-B		X		X	312-A
Synthetic Design	325-A	X	X			301
Synthetic Design*	325-B					325-A
Cotton Weaving#	321	X		X		None
Woolen & Worsted Weaving	322	X		X		None
Loom Fixing	324		X		X	None

* Not offered in 1947-1948
\# Tentative

Description of the above courses

301. This subject covers weaves of all types from the simple plain weave through the fancy and figured weaves, including the harness draft and chain. Yarn counts and sizes for all systems including plyed and fancy yarns are also covered.

311-A Cotton cloth analysis and design are combined, beginning with plain fabrics and leading into the more fancy dobbies.

311-B More elaborate cotton fabrics are taken up such as filling backed, warp backed, plied, velvet, leno, etc.

312-A Woolen cloth analysis and design. It includes blankets, bathrobings, filling reversibles, extra warp and filling backs, figured effects, double cloths and plaid backs.

312-B Woolen and worsted fabrics advance to the more complicated types, some of which are chinchilla, melton, kersey, as well as suitings. Cost estimation for both woolen and worsted fabrics.

325-A Cloth analysis and design of synthetic fabrics, including both filament and spun yarn.

325-B A continuation of 325-A covering the more fancy and complicated types of synthetics.

321 The course in cotton weaving covers plain looms, Draper and Stafford automatic looms, warp preparation and drawing-in. Lecture and laboratory.

322 This subject covers the Crompton & Knowles loom for woolens and worsteds including all motions and constructions together with both wet and dry dressing. Lecture and laboratory.

324 Loom fixing includes the timing of all the different motions in the loom as well as the remedies for improper setting. Box chains and harness chain planning and building is included. Lecture and laboratory.

Certificates

The certificate of the school is awarded for the successful completion of the following groups of courses:

Cotton Design Certificate
For completion of courses 301, 311-A, 311-B

Woolen and Worsted Design Certificate
For completion of 301, 312-A and 312-B

Synthetic Design Certificate
For completion of 301, 325-A and 325-B

Cotton Weaving Certificate . . . . For completion of 321

Woolen and Worsted Weaving Certificate For completion of 322

Loom Fixing . . . . For completion of 324

ART DEPARTMENT

Staff

Prof. Vittoria Rosatto, B. S., in charge of department

Jane Biggart

Elbert G. Bowring

Gerardine Curley

Roy Flanders

Mary S. Kiernan

Noela Landry

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Freehand Drawing	313-A					
Section I		X		X		
Section II			X		X	None
Life Drawing	313-B	X	X			313-A
Color Harmony	313-C	X		X		313-A
Perspective Drawing	313-D		X		X	313-A
Silk Screen Printing	326		X		X	313-A
Show Card Design	314-A	X		X		None
Advanced Show Card Design	314-B		X		X	314-A
Pattern Alteration*	316	X		X		None

* Tentative

Description of the above courses

313-A Drawing in charcoal from casts and group arrangements of still life. Pastel drawing of still life groups. Both Section I and II cover the same material.

313-B Drawing from the live model in charcoal and later in pastel. Individual and class instruction i nanatomy.

313-C The color wheel, value and chroma together with the various harmonies are taught by means of painted problems.

313-D The use of vanishing points and measuring points in expressing depth on a two dimensional surface.

326 The student is taught to cut and adhere stencils to the silk screen, print on fabric and set the color.

314-A Pencil drawing of the alphabet and simple layouts of card signs executed in paint.

314-B A continuation of 314-A with the addition of advanced design and color schemes.

316 The student is taught to understand the alterations of the commercial garment pattern as well as alterations for the student's own figure.

Certificates

The certificate of the school is awarded for a three year course in Decorative Art consisting of 313-A and any two of the four courses313-B, 313-C, 313-D, 326.

A certificate is also awarded for the completion of 314-A and 314-B.

CHEMISTRY DEPARTMENT

Staff

Prof. Elmer E. Fickett, B.S., in charge of department
Asst. Prof. Charles L. Howarth, B.T.C.
Asst. Prof. John H. Skinkle, S. B., M.S.
Asst. Prof. Charles A. Everett, B.T.C.
Asst. Prof. William G. Chace, Ph.B., M.S.
Asst. Prof. Paul C. Panagiotakos, S.B., Ph.D.
Mr. Charles L. Daley, B.T.C.
Mr. Ernest P. James, B.T.C.
Mr. Walter J. Lisien, B.T.C.
Mr. Elmer P. Trevors

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
General Chemistry	411-A		X	X	X	None
General Chemistry	411-B		X	X	X	411-A
Qualitative Analysis & Stoichiometry	411-C	X	X		X	411-B
Quantitative Analysis & Stoichiometry	413-A	X	X		X	411-C
Quant. Analysis & Stoichiometry	413-B	X	X		X	413-A
Quant. Analysis & Stoichiometry	413-C	X	X		X	413-B
Textile Chemistry & Dyeing	412-A		X	X	X	411-B
Textile Chemistry & Dyeing	412-B		X	X	X	412-A
Textile Chemistry & Dyeing	412-C		X	X	X	412-B
Dye Testing	416-A		X	X	X	411-B
Textile Testing & Microscopy	416-B	X		X	X	416-A
Textile Testing & Microscopy	416-C	X		X	X	416-B

Description of the above courses

411-A, 411-B — A two year course in general chemistry. The first year covers the basic principles of inorganic chemistry. Laboratory work parallels the lectures. The second year is a continuation of the first year giving more advanced theory and modern industrial and commercial processes. It also includes the basic principles of organic chemistry.

411-C — A basic course in the systematic analysis of inorganic compounds, carried out by the student in the laboratory. Chemical calculations and the balancing of chemical equations is covered in the stoichiometry portion of the course.

413-A, 413-B, 413-C — This three year course covers the underlying principles of analytical chemistry with sufficient laboratory work to enable the student to become proficient in performing routine analyses in a textile plant. The third year consists of the analysis of soap, water, oils, coal and other material of interest to the textile chemist.

412-A, 412-B, 412-C — This course covers three years work of lectures and laboratory in the following topics: the action of chemical reagents on the natural and synthetic fibers, the preparation of the fibers for dyeing, the application of all classes of dyes to cotton, wool, silk, synthetic, and union materials.

416-A This course covers the necessary principles of dyeing and concentrates on the testing of dyes for fastness to light, washing, perspiration, etc. by modern laboratory testing technique. Lecture and laboratory.

416-B } 416-C } A continuation of the testing procedure of 416-A. It includes the physical testing of fibers, yarns and fabrics for such qualities as counts, twist, strength, crimp, handle, etc.; the chemical testing of textile materials for impurities, content and quality; and the construction and theory of the microscope and its use in textile identification and quality determination. Lectures and laboratory.

Diplomas

A diploma in Analytical Chemistry will be awarded for the successful completion of courses 411-A, 411-B, 411-C, 413-A, 413-B, and 413-C. This normally takes six years of three evenings per week.

A diploma in Textile Chemistry and Dyeing will be awarded for the successful completion of courses 411-A, 411-B, 412-A, 412-B, 412-C. This normally takes five years of three evenings per week.

A diploma in Physical and Chemical Textile Testing will be awarded for the successful completion of 411-A, 411-B, 416-A, 416-B and 416-C. This requires five years of three evenings per week.

Only high school graduates (or the equivalent) are eligible to enroll for diploma courses in chemistry. The work covers the same ground and is held up to the same standard as the corresponding day school courses and will be accepted for day school credit towards the B.S. degree of the Lowell Textile Institute.

Certificate

For those wishing only a general knowlege of chemical fundamentals, a certificate will be issued for the completion of General Chemistry 411-A and 411-B.

ENGLISH DEPARTMENT

Staff

Prof. Lester H. Cushing, A.B., Ed.M., in charge of department
Asst. Prof. James G. Dow, A.B.

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
English composition	511-A	X				None
English Composition	511-B				X	511-A
Appreciation of Literature	512		X			None

Description of the above courses

511-A The fundamentals of composition including remedial English, grammar and rhetoric.

511-B A course in how to write clearly and correctly. An intensive study is made of narration, description, exposition, argumentation and the art of letter writing.

512 A course for those wishing to enlarge their cultural background and study the principles of literary appreciation and criticism. Prose and poetry will be treated analytically with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative and the philosophical.

Certificates

The certificate of the school will be awarded for the successful completion of 511-A and 511-B.

BUSINESS AND INDUSTRIAL MANAGEMENT

Staff

Prof. Herman H. Brase, Guest lecturer
Asst. Prof. Charles F. Edlund, S.B., Ed.M.
Mr. Arthur Erickson

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Principles of Salesmanship	650				X	None
Principles of Advertising	651	X				None
Industrial Psychology	513		X			None
Technique of Employee Leadership	652	X			X	None
Foremanship	653	X		X		None

Description of above courses

650. The fundamentals of salesmanship including the psychology of selling, building a selling talk, showmanship, elements of successful selling, wholesale and retail salesmanship, etc. Lectures plus student participation.

651. The fundamentals of advertising including psychology, copy writing, layout, production, testing, campaigns, etc. Lectures and assignments.

513. In this course the psychologist helps the student to apply to himself in industry the principles and facts of psychology. It recognizes the human element in production. Topics treated are employment principle, on the job training and growth, psychological factors in efficiency and safety, morale and getting the most out of your job. Lectures and discussions.

652. A study of the psychological principles in employee leadership for those who occupy, or aspire to, executive positions. Topics treated include job training, interpretation of management to employees, leadership function in safety, handling of grievances, etc. Lectures and discussions.

653. A course in foremanship principles and problems based on the Foremanship Management Conference Manuals of the National Foreman's Institute. It is designed to help men now acting as foremen in a more successful handling of their job and is conducted by the conference or seminar method, each man bringing in his own problems for analysis by the group. Some of the topics include understanding people, the foreman as a leader, eliminating irritations, training workers on the job, getting along with the man above, eliminating waste, wage incentives, cost factors the foreman can control, etc.

Certificates

A certificate in Selling and Advertising will be awarded for the completion of both 650 and 651.

A certificate will be awarded for the completion of 652 and also for the completion of 653.

ENGINEERING DEPARTMENT

Staff

Prof. Herbert J. Ball, S.B., B.C.S., F.T.I., in charge of department
Asst. Prof Harry C. Brown, S.B.
Asst. Prof. A. Edwin Wells, B.T.E., Ed.M.
Asst. Prof. Charles F. Edlund, S.B., Ed.M.
Asst. Prof. Horton Brown, B.S.
Asst. Prof. Milton Hindle, B.T.E.
Mr. Paul D. Petterson
Mr. Elliot F. Humiston, S.B.
Mr. Henry E. Thomas, B.T.E.
Mr. Maurice E. Gelinas, S.B., A.M.
Mr. Robert M. Kennedy, B.T.E.
Mr. Isaac Chase, Jr., B.S.
Mr. Andrew A. Ouellette, Sc.B.

Mathematics and Engineering Subjects

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Mathematics	620-A	X		X		None
Mathematics	620-B		X		X	620-A
Mathematics	645	X		X		None
Mechanical Drawing	613-A	X		X		None
Mechanical Drawing	613-B		X		X	613-A
Mechanical Drawing	613-C		X		X	613-B
Blue Print Reading	638		X			None
Machine Shop Practice	614-A	X		X		None
Machine Shop Practice	614-B		X		X	614-A
Strength of Materials	621		X		X	None
Steam	622	X		X		None
Mechanism	630		X		X	None
Diesel Engines	632		X		X	None
Air Conditioning	634-A	X		X		None
Air Conditioning	634-B		X		X	634-A
Textile Testing	639	X		X		None

Description of above courses

620-A Algebra including addition, multiplication, subtraction, division, factoring and fractions.

620-B A continuation of 620-A. Some of the topics treated are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule, and some trigonometry.

645 An accelerated course in algebra for those satisfying the instructor as to their ability to pursue it. It covers algebra from the beginning to beyond quadratics.

613-A, 613-B, 613-C A complete three year course covering the principles of mechanical drawing including projections, penciling, sketching, inking, lettering, tracing, detail and assembly drawing.

638 A short course for those who wish to understand the principles of mechanical drawing such as projections, sections, dimensioning, etc. in order to read and understand blue prints.

614-A, 614-B Metal working, including bench work, lathes, grinders, planers, shapers, presses, milling machines, care of tools, tool grinding, etc.

621 A basic course in strength of materials covering such topics as tension, compression, shear, cast iron, wrought iron, steel, timber, design of bolts, tie rods, columns, boiler shells, riveted joints, etc., beam theory, torsional stresses, shafts, etc.

622 Heat generation, transmission, and utilization. Topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, testing, etc. Lectures and assignments.

630 A study of the principles used in the transmission of force and motion through machines and mechanical devices. Topics covered are mechanics, accelerated motion, moments of force, pulleys, belting, gears, cams, etc.

632 An elementary study of diesel engines, their operation, and maintenance. Topics covered include types of diesels, fuel oils, fuel injection systems, combustion, cooling systems, application, maintenance, etc. Lectures and assignments.

634-A A two year course in the principles of air conditioning covering
634-B the fundamental laws, physical properties of the atmosphere, measuring instruments, heating, cooling, humidification and dehumidification systems, air filtration, refrigeration, etc. Lectures and assignments.

639 The determination of the physical properties of textiles and the evaluation of test data. The topics covered include textile fibers and their properties, testing machines, breaking strength, elongation, fabric structure, bursting strength, crimp, twist, regain, etc. Lectures and laboratory.

Certificates

The certificate of the school is awarded fo rthe successful completion of the following courses or groups of courses described above: 620-A and 620-B; 645; 613-A, 613-B and 613-C; 638; 614-A and 614-B; 621; 622; 630; 632; 634-A and 634-B; 639.

ELECTRICITY

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
		EVENINGS				
Electrical Circuits	644	X		X		None
D. C. Machinery	636-A		X		X	644
A. C. Machinery	636-B		X		X	644
Fundamentals of Electronics	640		X		X	644
Industrial Electronics	641			X	X	640
Principles of Radio	642	X		X		640
Cathode Ray Oscilloscope*	643					640

* Not offered in 1947-1948

Description of the above courses

644. A basic course in direct and alternating current circuits. Topics include: Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance, etc. Lecture and laboratory.

636-A D. C. Machinery. The theory and operation of generators, motors, power plant switchboards, etc. Industrial application of D. C. machinery, parallel operation, etc. Laboratory work covers methods of operating and testing D.C. equipment.

636-B A.C. Machinery. Topics include application of instruments to A.C. circuits, alternators, transformers, power plant switchboards, induction motors, synchronous motors, single phase, polyphase (delta and three phase, four wire systems), etc. Laboratory work covers operation and testing of equipment.

640. The fundamentals of electronics. Topics include vacuum tube theory, vacuum tube applications including rectifiers, power supplies, amplifiers, classes of amplifiers, voltage gain and power amplifiers, electronic instruments, etc. Lecture and laboratory.

641. The theory and operating characteristics of gas and vacuum tubes, photo-electric cells, and the thyratron. Topics covered include amplifiers, electronic relays and timers, thyratron applications, phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Lecture and laboratory.

642. Principles of radio. Audio systems, microphones, loud speakers, radio wave propagation, antennas, transmission lines, amplitude and frequency modulation, radio transmitters, modulators, detectors, receivers, tracking and alignment, servicing instruments, etc. Lecture and laboratory.

643. The theory of the cathode ray tube including elementary electron optics, block diagram, electrostatic and magnetic deflection. Sweep circuits, saw-tooth oscillators, wobbulators, power supplies, deflection plate amplifiers, and oscilloscope circuits. Laboratory application of the oscilloscope and auxiliary equipment in wave form study, frequency measurement, response curves, distortion, modulation, etc.

Certificates

A certificate in Electrical Machinery will be awarded for the successful completion of 644, 636-A and 636-B.

A certificate in Industrial Electronics will be awarded for the successful completion of 644, 640 and 641.

A certificate in Radio will be awarded for the successful completion of 644, 640 and 642.

A certificate in the Cathode Ray Oscilloscope will be awarded for the successful completion of 644, 640 and 643.

FINISHING DEPARTMENT

Staff

Prof. Cornelius L. Glen, in charge of department
Asst. Prof. Winford S. Nowell, B.M.E.

SUBJECT and NUMBER		EVENINGS Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Woolen & Worsted Finishing	710	X		X		None
Cotton Finishing*	711					None

* Not offered in 1947-1948

Description of above courses

710. The finishing of both woolen and worsted cloths. Some of the topics covered are burling, mending, fulling, washing, speck dyeing, carbonizing, gigging, napping, steaming, brushing, shearing and pressing. Lectures and some laboratory demonstration.

711. The finishing of cotton and synthetic fabrics. Some of the topics covered are inspecting, trimming, shearing, singeing, washing, napping, mangles, starching, dryers, stretchers, callenders, folding and marking. Lectures and some laboratory demonstration.

Certificates

The certificate of the school will be awarded for the succeessful completion of either of the two above courses.

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OLIGOMERIC CONDENSATION PRODUCTS FROM β,β'-DICHLORETHYL ETHER AND BENZENE

by

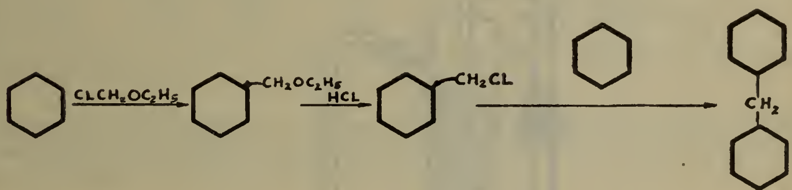
P. C. Panagiotákos,
Ademar V. Rocha,*
José F. Valente*

This laboratory has for some time been interested in high-molecular-weight hydrocarbons and ethers. Because of their inherent inertness to chemical and physical agents it can be safely presumed that the future will see more attention focused on macromolecular compounds of this type for general plastic use as well as for the production of fibrous material for the textile industry.

In the course of these investigations we had occasion to study the reaction of β,β'-dichlorethyl ether and benzene in the presence of $AlCl_3$. Theoretically, the possibility of polycondensation in this system would give rise to a macromolecular hydrocarbon. Macromolecular ethers must be excluded from the realm of possible end-products under most conditions in view of the activity of ether linkages to $AlCl_3$. It was, however, not our intention to produce such macromolecules in this investigation but to study primary reaction products in the hope of casting some light on reaction mechanism.

Shinkle[1] has described interesting macromolecular products which are flexible, infusible, heat-resistant and substantially insoluble in and unaffected by water, alkalis, acids and many organic solvents. These products are obtained by the condensation of one mol of an aromatic compound of general formula RC_6H_4R' (Where R and $R' = H$ or saturated aliphatic radical containing more than 1 carbon atom) with an ethylene dihalide in the presence of $AlCl_3$. In view of the properties of these polycondensate materials they should be of decided interest as a possible source of fibrous material of extreme stability and resistance.

Ishikawa and Maeda[2] have shown that benzene and ethylenechlorhydrin in the presence of $AlCl_3$ give s-diphenylethane. Verley,[3] upon reacting benzene with chlormethyl ethyl ether obtained diphenylmethane and benzyl ethyl ether and proposed the following mechanism: —



Testing Verley's mechanism Houston and Friedmann[4] interacted benzyl ethyl ether with benzene and $AlCl_3$ and obtained diphenylethane and small amounts of anthracene. But the reaction was far less vigorous and the yield of benzyl ethyl ether much lower than in the case of the reaction of benzyl alcohol and benzene in the presence of $AlCl_3$. Hence Houston and Friedmann concluded that benzyl ethyl ether was relatively stable to $AlCl_3$ and theorized that good yields of this ether should be obtainable by the reaction of benzene and chlormethyl ethyl ether. An investigation of this reaction between benzene and chlormethyl ethyl ether in the presence of $AlCl_3$ was found to be vigorous, but no benzyl ethyl ether was isolated. Houston and Friedmann then came to the conclusion that the Verley hypothesis of the intermediate benzyl ethyl ether formation was untenable and theorized that the oxygen linkage of the chlormethyl ethyl ether ruptured before undergoing interaction with the benzene. To substantiate this theory Houston and Friedmann point to the formation of formaldehyde by the action of $AlCl_3$ on the chlormethyl ethyl ether alone.

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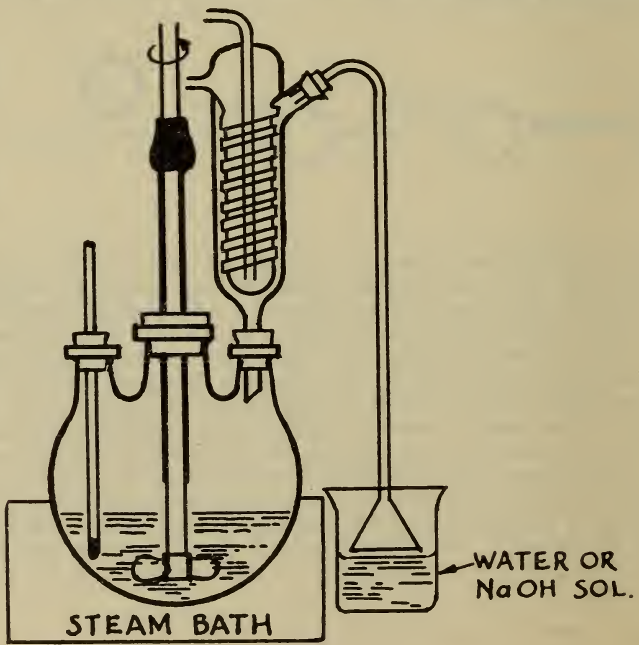
By the polycondensation of benzene with ethylenedichloride in the presence of $AlCl_3$ Sisido and Kato[5,6] have confirmed the results of Shinkle and shown that elastomers as well as other resinous products may be obtained. Similar products are reported by these authors[7] as obtainable by the action of $AlCl_3$ on β-phenylethyl chloride. Commercially, macromolecular condensates of this type are known as AXF. By the oxidation of these products to terephthalic acid these authors have shown the condensation to take place in the para positions although a trace of isophthalic acid is also reported obtained in one instance. As identified intermediate compounds Sisido and Kato[6] have isolated s-diphenylethane and m-di (β-phenylethyl) benzene, m. pt. 56–7°. This compound was synthesized by the Wurtz-Fittig method for comparison purposes.[8] The close structural relationship of this compound to the strongly carcinogenic 1, 2, 5, 6- dibenzanthracene and the rearrangement of the former into the latter via the para isomer is pointed out by Sisido.[8]

In our work with β,β'-dichlorethyl ether and benzene we have discovered that for the substantial initiation of the reaction two conditions must be observed, first the ratio of $AlCl_3$ to ether must be above the equimolecular and second the temperature must be over 70° except in the highest $AlCl_3$: chloroether ratios i.e. ca. 1.5:1 in which reaction sets in spontaneously with evolution of heat. Most of the work was done with a 5:1:1.1 to 5:1:1.5 molecular ratio of benzene: β,β'-dichlorethyl ether: $AlCl_3$ at the reflux temperature (ca. 86–88°).

The nature and yield of the reaction products is influenced, as might be expected, by the catalyst ratio and by the reaction time. Thus the higher the catalyst ratio and the longer the time, the higher the yield of higher-boiling products. Numerous reaction products have been obtained, three in good purity, one in fairly pure form and many, in the higher boiling products, which were not isolated in pure form. A number of colored products, golden yellow, orange, red-orange, some with green fluorescence have been obtained from the higher boiling fractions. It is impossible in a publication of this length to give a complete detailed account of all the experimental work. The complete report is to be published elsewhere. Here there is presented a rather generalized synopsis.

EXPERIMENTAL

The apparatus consisted of a 3-neck-flask provided with a thermometer, motor-driven-stirrer, and a Friedrich condenser leading to a funnel which almost touches



the surface of a sodium hydroxide solution provided for the absorption of the HCl:

The usual manner of performing the reaction was to mix the thiophene-free benzene and chlorether, b.pt. 174–5°, add the $AlCl_3$ while stirring and heat to reflux for two to six hours. The product was worked up by pouring into ice-cold ca. 2N HCl for decomposition of the $AlCl_3$ or $AlCl_3$ complexes, washing with NaOH solution, ca. 1N, and with H_2O till neutral and drying by $CaCl_2$. In the case of too viscous products which would give poor settling during the NaOH wash the product would be diluted by added benzene.

After distilling off the excess benzene by collecting distillate up to ca. 105°, atm. pressure, unreacted ether is distilled off under ca. 15–20 mm. in the range of ca. 100–140°, leaving behind a dark viscous reaction liquid.

ISOLATION OF COMPOUNDS

1. **s-Diphenylethane.** The crude reaction liquid, after removal of benzene and chlorether is kept under the ca. 15–20 mm. distillation collecting any fraction that comes over at 140–160°C. This fraction, which is practically colorless, solidifies to crystals which after recrystallization from alcohol are colorless and melt at 52°. Mixed melting point with s-diphenylethane, m.p. 52°, shows no depression and cryoscopic molecular weight in benzene yields the value 175 (theor. 182).

2. **Oligomeric Compounds Isolated in Pure State.** The crude product, after the removal of the s-diphenylthane is vacuum distilled under ca. 1–2 mm. up to ca. 300°. From the lower boiling fractions, ca. 200°, of this distillate we have isolated two colorless crystalline compounds of m. pt. 87–8° and 43–4° by crystallization from alcohol. The 88° compound being first obtained and the 44° compound being obtained by further crystallization of the 88° liquor.

In one experiment with a 1.3:1 molal ratio of $AlCl_3$: chlorether a colorless liquid of violet fluorescence was obtained as a distillate at 270–85°, atm. pres. In this experiment the $AlCl_3$ is believed to have been inadvertently partially hydrolyzed before use.

The identity of these three compounds has not been established but combustion analysis gives results which are in accord with the empirical formula C_xH_x: —

Compound	*% C*		*% H*		*Description of Compound*
87–8° (I)	92.1	92.3	7.7	7.7	Beautiful, white pearly scales
43–4° (II)	92.3	92.5	7.7	7.7	White powder
Liquid (III)	92.2	92.0	7.8	7.8	Pract. colorless liq.*

* The small amount of this product prohibited a further manipulation for the procurement of a sharper-boiling compound.

One would expect oligomeric hydrocarbon products obtainable by this reaction and having the composition C_xH_x, as an examination of the simple condensation products will show the following possibilities: —

Dinuclear	$C_{14}H_{14}$	s-Diphenylethane
Trinuclear	$C_{22}H_{22}$	0-Di-(β-phenylethyl) benzene
	"	m- " " "
	"	p- " " "
Tetranuclear etc.	$C_{30}H_{30}$	etc.

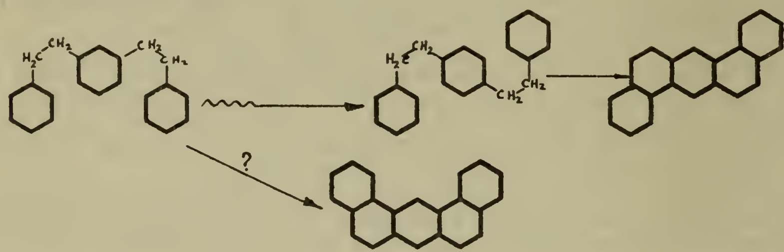
Unfortunately the investigation is not complete at the present time but the question of the identity of our three hydrocarbons poses an interesting question. Of course, assuming the 56–7° melting compound of Sisido and Kato,[6] of Sisido,[8] to be m-di (β-phenylethyl) benzene, none of our three hydrocarbons I, II, III can be the m-di-isomer. These compounds are under investigation at the present.

CONCLUSIONS — THEORETICAL

It has been shown that the condensation of β,β′-dichlorethyl ether and benzene in a 1:5 molecular ratio; with from 1.1 to 1.5 mol of $AlCl_3$ at reflux temperature for up to 6 hours, gives principally oligomeric polycondensates and judging from the

viscosity of the end-products very little, if any yield of high macromolecular polycondensates. Definitely identified as a product of reaction is s-diphenylethane. Three other C_xH_x hydrocarbons have been isolated, one liquid and two solids of sharp m. pt. (43–4° and 87–8°). These three hydrocarbons are therefore low condensates. Inasmuch as the liquid product (No. III) was isolated from the experiment in which we believe the $AlCl_3$ had been partially hydrolyzed by exposure to the atmosphere, it may be that this compound is a more sensitive intermediate than I and II. Higher boiling fractions of unknown constitution have also been obtained. Some of these have been for six months undergoing slow crystallization.

Thus, of the compounds subjected to combustion analysis all three have shown the C_xH_x ratio; the s-diphenylethane also has this composition. In the fractions containing I, II and III, compounds of the dibenzanthracene type might be expected, especially in view of the higher temperature employed by us than by S and K and the greater possibility for molecular rearrangement. Of course the formation of the dibenzanthracene type hydrocarbon would result via dehydrogenative cyclization or as has already been indicated by Sisido[8] by rearrangement prior to dehydrogenative cyclization.



Although we have not isolated any dibenzanthracenes, it should be pointed out that, in view of the carcinogenicity of these hydrocarbons, (e.g., of 1, 2, 5, 6–dibenzanthracene) and the possibility of their formation in the β,β'-dichlorethyl etherbenzene condensation, it would be wise to exercise proper caution when handling the reaction products, particularly if such handling is continual.

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STATISTICS AND TEXTILES

by

Jacob K. Frederick, Jr.*

I. Introduction

A dictionary defines statistics as:

> "Statistics, n., the science of the classification and arrangement of facts relating to the condition of a people or class, domestic economy, health, longevity, etc."

Also, less precisely, statistics has been spoken of as that branch of mathematics which permits any one to prove anything, and Mark Twain is considered the author of the classification of lies into "lies, damned lies, and statistics." It is small wonder, therefore, that the word produces a variety of reactions in different persons.

The modern concept of the word statistics is that it denotes the "quantitative expression of knowledge—the marshalling of facts and their arrangement in a form suitable for scrutiny and analysis in order to serve as the basis for judgment" (J. G. Smith, Elementary Statistics). Statistics did not come into existence full-blown as such, but rather, it has grown to its present position through many years over a path which at times has been beset with obstacles and which at other times has been as a broad highway.

The present century has witnessed not only extreme rapidity in the growth of mathematical statistics, but also in the application of statistics to numerous phases of what are customarily regarded as everyday life. In many fields, this growth can be traced to the development of the control chart technique by W. A. Shewhart of the Bell Telephone Laboratories in the 1920's and the perfection of elaborate calculating and computing machines. The recent war speeded up work in all phases of statistics, with the result that today it is possible to apply statistics as a practical working tool to numerous human activities without having to worry too much about the lack of a mathematical background. This has come about through the development and dissemination of plans for the application of statistics, particularly in the field of quality control. The American Standards Association in 1941 brought out a handbook entitled "Guide for Quality Control and Control Chart Method of Analyzing Data," which expedites the application of statistical principles to quality control problems with a minimum of statistical knowledge on the part of the actual users of the plan, although some knowledge is required in order to evaluate the particular application involved. Sequential sampling plans developed during the recent war years make possible the quality controlling of material subject to inspection in terms of attributes by relatively untrained help.

In the field of textiles, the demands of the recent war for millions of yards of fabric and related textile materials in tremendous volumes made the inspection or testing of such volumes by previously used techniques impractical, so that this field proved extremely fruitful for statistical exploitation, with the result that many textile concerns had their first taste of statistics, and in some cases found the taste to be bitter. In all cases wherein statistical principles were correctly applied, considerable savings in material and money resulted, and also, for the first time, many a manufacturer obtained a true measure of his own quality level. The textile industry at the present time has a foot in the door of statistics in the existence of one of the sub-committees making up Committee D-13 on Textiles of the American Society for Testing Materials.

Today, activity in the field of statistics is divided between two extremes. One of these extremes is represented by the pure mathematical statistician engaged in the understanding and exploration of fundamental relationships

* Assistant Professor, Lowell Textile Institute.

STATISTICS AND TEXTILES

ERRORS AND CORRECTIONS

[illegible]ge [illegible]. Table V

Upper limit for $\bar{X}$ should read 1.770
Lower limit for $\bar{X}$ should read 0.[illegible]0

These values relocate the upper and lower control limits in Fig. 2, $\bar{X}$, however they do not basically alter the general conclusions arrived at, although Subgroup 5 now falls just below the lower limit, and the conclusions given as applying to Subgroup 10 now apply to Subgroup 6 also, however the departure from control of Subgroup 5 is not as great as that of Subgroup 10.

[illegible]ge 11. Table VI

The mean values under the elongation results should read as follows:

	Elongation Results, %		
	Untreated Fabric	Treatment A	Treatment B
Mean Values	18.8	16.3	15.8

[illegible]ge 12. Formula (8) should read

$$= (s_1^2 \ldots$$

Formula (7a) should read

$$L_1 =$$

without regard to their practical applications, while the other is represented by the so-called quality control technician engaged in the application of statistics to problems arising within a given field of work in order to more clearly evaluate these problems. The purpose of the rest of this paper is to bring forth the application of statistics, with particular reference to the textile industry, rather than to discuss the mathematical concepts underlying the field of statistics as such.

II. A Few Concepts

While this paper is primarily devoted to the application of statistical principles, it is unreasonable to assume that this can be done without at least a nodding acquaintance with the terms which will be used and the framework around which the applications will be built, just as textiles cannot be discussed without an understanding of the fundamentals of textile operations.

Among the many concepts used by statisticians, the following are probably as close to the foundation stones as it is possible to get:

1. Universe or population
2. Sample
3. Randomness
4. Distribution
5. Measures of central tendency
6. Measures of dispersion
7. Normal curve

A statistical UNIVERSE or POPULATION is a basic group or family of objects all possessing one or more characteristics in common. A large quantity of cotton yarn spun from a known group of bales of raw cotton during a certain time period would result in a population in which the shared characteristic could be the breaking strength of the yarn. In some cases, the term universe is given a qualified meaning in that it refers to a sequence of measurements or numbers which is either completely known or about which reasonably valid assumptions can be made. Thus, if every possible breaking strength test was made throughout the entire length of yarn making up a three pound cone of rayon, these tests could be referred to as a self-contained or limited universe. By and large, a population is usually assumed as being homogeneous, especially in studies involving the effect of different operational procedures on a given characteristic, although serious errors in statistical work can result from failure to verify such an assumption.

As it is usually impossible or highly impractical to work with entire populations, work is actually predicated upon a SAMPLE taken from the population in question. Thus, in the case of the very large number of strength tests which could be made upon the cone of rayon yarn, common sense would dictate the drawing of a sample from the cone upon which a number of observations or tests would be made. If this sample is taken in accordance with sound statistical principles, then it can be clearly shown that it bears a definite relationship to the population involved. However, if proper consideration is not given to the sampling, then all subsequent work is apt to prove meaningless when translated in terms of actual plant operations.

The statistical foundation for the assumption that a given sample can be considered representative of a population is based upon the notion of RANDOMNESS. Essentially, the concept of randomness is intuitive, and operationally, a random sequence of events can be demonstrated by drawing and replacing numbered and physically similar chips from a bowl. One of the most important requirements for all quality control work is that randomness exist in the sampling.

In an industrial sense, it has been only within the last hundred years or so that manufacturers have become aware of the fact that they were incapable of making a given product exactly as they desired to. That is, a fabric cannot

be woven to have exactly fifty pounds breaking strength throughout its entire length and width, but rather, the actual breaking strength will tend to vary from portion to portion due solely to the nature of the fabric and exclusive of all assignable factors as operator technique, machine error, and the like. This variation of a given characteristic of a population results in the formation of a DISTRIBUTION, and such a distribution is associated with every characteristic of a population, this distribution being grouped around an average with a certain spread or dispersion existing. Returning to the breaking strength of the fabric, the average or central tendency of all the tests made might be 50 pounds, with a distribution from 42 to 57 pounds, and a dispersion or spread (range) of 15 pounds.

There exist several methods of indicating a CENTRAL TENDENCY for a group of measurements, the most common of which is the arithmetic average or mean. In statistical shorthand, this is symbolized by:

$$\bar{X} = \frac{\Sigma X}{n} \tag{1}$$

wherein X is an individual observation or test result,
ΣX is the algebraic sum of all the values of X,
n is the number of observations made,
$\bar{X}$ is the arithmetic mean or average.

The use of the arithmetic mean has a great advantage, and also one serious drawback. The advantage is that the means of small, equal subgroups may be averaged to obtain $\bar{\bar{X}}$, or the grand average of the subgroups involved. The disadvantage is that it is unduly influenced or distorted by the existence of extreme values of X.

Other measures of central tendency such as the mode, median, geometric mean, quadratic mean, and harmonic mean are seldom met with in the ordinary pursuit of statistical quality control, and accordingly will not be discussed herein.

The most commonly used measure of DISPERSION in statistical work is the standard deviation, which is symbolized by the Greek small letter sigma:

$$\sigma = \sqrt{\frac{\Sigma (X-\bar{X})^2}{n}} \tag{2}$$

For ease in computation, this is usually written as follows:

$$\sigma = \sqrt{\frac{\Sigma (X)^2}{n} - \bar{X}^2} \tag{2a}$$

wherein σ is the standard deviation of a universe or statistical population,
$\Sigma (X)^2$ is the sum of the squared individual observations or values of X,
$\bar{X}^2$ is the square of the arithmetic mean,
n is as defined in (1), the number of observations made.

It will be noted that σ was referred to as the standard deviation of a universe. As universes are seldom dealt with in the ordinary run of statistical work, it is necessary to arrive at the best estimate for σ in terms of the data actually collected. The best estimate for σ is calculated from the formula:

$$s = \sigma\sqrt{\frac{n}{n-1}} \tag{3}$$

wherein s is the best estimate of σ based on the data at hand.

The range R is another method of expressing dispersion, it being merely the difference between the highest and lowest values of X for n observations. While the range is extremely easy to compute, it should never be used when n is greater than 10. Indeed, by preference, it should be used only when n is between 2 and 6, for it becomes increasingly erratic with respect to true significance for groups of larger size. Its principal field of application is in the consideration of subgroups of observations.

While these two measures of dispersion are by no means all such tools available to the statistical worker, they are nonetheless the most useful in the industrial and quality control fields, with such measures as quartiles being used in conjunction with the median in psychological work.

There remains one more concept of importance before getting down to cases, and this is the concept of the NORMAL PROBABILITY CURVE or NORMAL CURVE. Original work involving the normal curve dealt with variations in the measuring process to the exclusion of additional variations which might exist in the object being measured. Three assumptions are usually made in its derivation:

1. Positive and negative variations of the same magnitude have equal chances for occurring.
2. Small variations are much more likely to occur than large ones.
3. The arithmetic mean represents the best estimate of the true or central value.

A normal curve can be plotted from data obtained by means of the probability laws. The usual example given by most writers is in reference to the tossing of a group of coins a great many times. Common sense indicates that if a dozen coins are tossed, the probability of all of them coming down as heads or as tails is small, however, such can occur. If heads are thought of as variations below the arithmetic mean and tails as variations above, the theoretical occurrence of different combinations of heads and tails can be calculated, and also, the formula expressing the relationship between the occurrences and the heads per toss can be determined. This formula is that for a normal curve, as either heads or tails are equally likely, and this formula can be expressed as follows:

$$Fc = \frac{n}{\sigma\sqrt{2\pi}} e^{-(X-\overline{X})^2/2\sigma^2} \tag{4}$$

wherein Fc is the computed frequency at a distance $(X-\overline{X})$ from the mean $\overline{X}$,

n is the number of tosses,

π is the constant 3.14159,

e is the base of Napierian logarithms, 2.71828.

The general shape of the curve resulting from the solution of this formula for specific cases is illustrated in Figure 1.

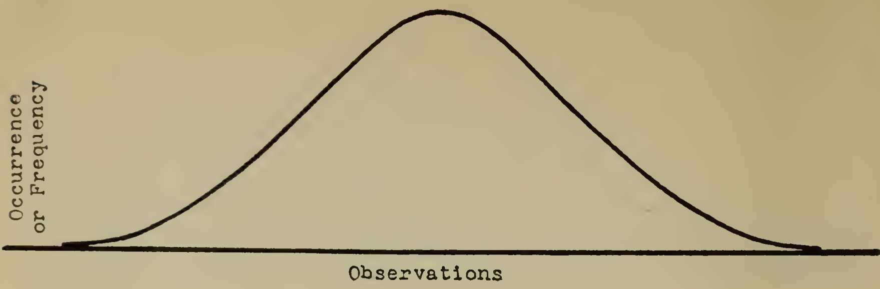

Fig. 1 NORMAL CURVE

It must be emphasized that the laws of probability and the normal curve are the result of actual trials or purely empirical work; they are generalizations from specific cases.

The normal curve fits into statistical work because it has been demonstrated that nearly all the data that man has gathered fit such a curve; that is, the data are distributed about their arithmetic mean in the form of the normal curve. While all possible populations have not been measured, this assumption is felt to be reasonably valid. In the event that naturally occurring non-normal populations are found at some future time, work done at present on definitely non-normal populations has demonstrated that if the individual observations from such a non-normally distributed population are arranged in small subgroups and the arithmetic means of such subgroups considered, then these means are approximately normally distributed. Thus, non-normal populations are capable of handling in terms of the normal distribution curve.

III. Statistics and Textiles

The application of statistical principles to the textile industry is neither easier nor harder than their application to any other field of human endeavor. The statistical foundation is the same regardless of its final field of use; the only thing that must be considered is how to adapt known principles to the problem at hand. It is certainly true that the application of statistical principles is not work for which the dilettante is cut out, however, the use of a statistical program after it has been selected and properly established involves no more than intelligent supervision plus the wholehearted cooperation and understanding of all concerned.

Statistics can be applied to any operation involving measurements made in either qualitative or quantitative units. Today, statistical principles are used essentially in three ways:

1. To control quality during manufacture.
2. To establish specifications for the buying and selling of goods.
3. To evaluate experimental work.

In nearly every operation in a textile plant, certain applicable tests are usually made. Roving is checked for weight, yarn is tested for twist, dyestuffs are subjected to color strength examinations, and many more operations are checked for the sole purpose of measuring the material at hand in order to check its compliance with an established standard. These tests are not an end in themselves, but rather, they are the basis for predictions concerning the quality or compliance of the lot or batch from which they were taken. It is because such predictions are made that the principles of statictics so aptly apply.

The only absolute method of determining whether or not a given batch meets established standards is by one hundred per cent testing or inspection of the batch. Such testing is usually not applicable to most textile operations, and

so the use of samples is resorted to. Any sampling system, whether based on statistical principles or not, results in two extremes of operation, which in turn involve a risk in prediction:

1. The sample may occasionally indicate standard compliance when the lot as a whole does not comply.
2. The sample may occasionally indicate lack of standard compliance when the lot as a whole does comply.

The statistical sampling plan enables this risk to be known, so that if it be desired that the risk of occasionally rejecting a good lot as bad be small, all that need be done is to select the proper plan. Any sampling system not based on statistical concepts is not a sampling plan at all, but is merely a testing program, for not only is the risk involved not known, but the relationship of the sample to the lot is but at best a mere guess.

Today, the accepted method of quality control is by means of the quality control chart. This method has been subjected to extensive field use since its development by Shewhart, and accordingly has been adapted to a wide range of manufacturing activities.

In principle, the quality control chart technique consists of considering the test data in terms of small subgroups, and determining the relationship existing between these subgroups and the populations that they represent. Subgroups are used, for as previously pointed out, the distribution of subgroup arithmetic means is approximately normal, therefore the effect of a non-normal population in terms of single observations is nullified. The subgroups are made small (2 to 25 observations, with 5 or less usually recommended) so as not to conceal any indications of assignable cause variations in the data. The normal curve fits into the picture from the fact that the area under it has been computed in terms of standard deviation units, with the total area thereunder being represented as 100 per cent. Tables have been constructed showing the relationship of area against standard deviation units, and a few of these values are given in the following table.

Table I. Normal Curve Areas in Terms of Standard Deviations

Standard Deviation, $\pm X/\sigma$	Area, %
0.00	0.0000
.25	19.74
.50	38.30
.6745	50.00
.75	54.68
1.00	68.26
1.50	86.64
2.00	95.46
2.50	98.76
3.00	99.73
4.00	99.99366
5.00	99.99994

As the tails of the normal curve extend to infinity, it is not possible to calculate the number of standard deviation units for 100 per cent of the area. It will be noted that $\pm 3\sigma$ covers 99.73% of the area under the curve. For most statistical work, $\pm 3\sigma$ is accepted as including all of the pertinent data for a given population. From the normal curve, and for a given population, the probability of getting single observations outside a given number of standard deviation units can be determined. Thus, as $\pm 3\sigma$ corresponds to 99.73 per cent of the area under the curve, there are 27 chances in 10,000 that a given observation having a value greater than $\underline{X} \pm 3\sigma$ could come from the population having the values calculated for $\bar{X}$ and σ. Accordingly, the $\pm 3\sigma$ limit is commonly used

from an economic viewpoint as an indication of out of control results in a quality control program.

Quality control work can be considered as falling into two categories:

1. Control with no standard of compliance given, such as usually occurs in development, research or the initial manufacture of a new product.
2. Control with a standard of compliance given, such as occurs under established manufacturing conditions.

The technique covered by the ASA Standards Z1.1-1941 and Z1.2-1941, "Guide for Quality Control and Control Chart Method of Analyzing Data," is based in turn on the "ASTM Manual on Presentation of Data," and while the principles involved for control with and without standards of compliance are the same, different factors are used for each. Factors have been computed by the ASTM for samples made up of from 2 to 25 observations, and part of this table is given herewith.

Table II. Factors for Computing Control Chart Lines, Small Samples

	NO. OBSERVATIONS IN SAMPLES, n				
FACTORS	2	4	5	8	10
Chart For Averages					
Factors for Control Limits					
A	2.121	1.500	1.342	1.061	0.949
A_1	3.759	1.880	1.596	1.175	1.028
A_2	1.880	0.729	0.577	0.373	0.308
Factor for Central Line, C_2	0.5642	0.7979	0.8407	0.9027	0.9227
Chart for Standard Deviations					
Factors for Control Limits					
B_1	0	0	0	0.153	0.252
B_2	2.064	1.859	1.789	1.653	1.594
B_3	0	0	0	0.169	0.273
B_4	3.658	2.330	2.128	1.831	1.727

Table III gives the formulas for computing the quality control chart limits for control with no standard of compliance given.

Table III. Formulas for Control Chart Limits

Subgroup Data Used To Provide Standard	Average, $\bar{X}$	Standard Deviation, σ
Upper Limit	$\bar{\bar{X}} + A_1\bar{\sigma}$	$B_4\bar{\sigma}$
Central Line	$\bar{X}$	$\bar{\sigma}$
Lower Limit	$\bar{X}—A_1\bar{\sigma}$	$B_3\bar{\sigma}$

Tables II and III reproduced from "ASTM Manual on Presentation of Data" by permission of the American Society for Testing Materials.

As an illustration of the use of the quality control chart in connection with an operation for which compliance standards have not been established, consider the case of a finishing plant developing a new finishing technique which can be evaluated in terms of the shrinkage remaining in the fabric, but for which no limits have yet been established. A total of 10 lots are run, and from each lot 5 swatches are taken at random and tested for residual shrinkage in the length direction, the 5 swatches being considered to form a sample or subgroup. The following subgroup data are obtained.

Table IV. Subgroup Data Residual Shrinkage in Length

Subgroup Number	Subgroup $\bar{X}$	Subgroup σ
1	0.80	0.459
2	0.60	0.392
3	1.30	0.256
4	0.65	0.324
5	0.40	0.413
6	1.45	0.195
7	0.80	0.372
8	1.35	0.503
9	1.75	0.925
10	1.90	0.361
GRAND MEANS	$\bar{\bar{X}} = 1.100$	$\bar{\sigma} = 0.4200$

From the test results obtained, it is desired to know if the process is under control; that is, do the results represent values which could have been obtained from a normal population, or do they indicate the existence of variations greater than those due to chance alone? For this discussion, it is assumed that the test method itself exhibits satisfactory control.

In order to answer this question, the limits given in Table III are calculated, with values as shown in Table V.

Table V. Control Chart Limits for Data in Table IV

Limit	Average $\bar{X}$	Standard Deviation, σ
Upper Limit	1.815	0.8938
Central Line	1.100	0.4200
Lower Limit	0.385	0

Using the limits shown in Table V, and plotting the subgroup data shown in Table IV, a quality control chart such as illustrated in Figure 2 is obtained.

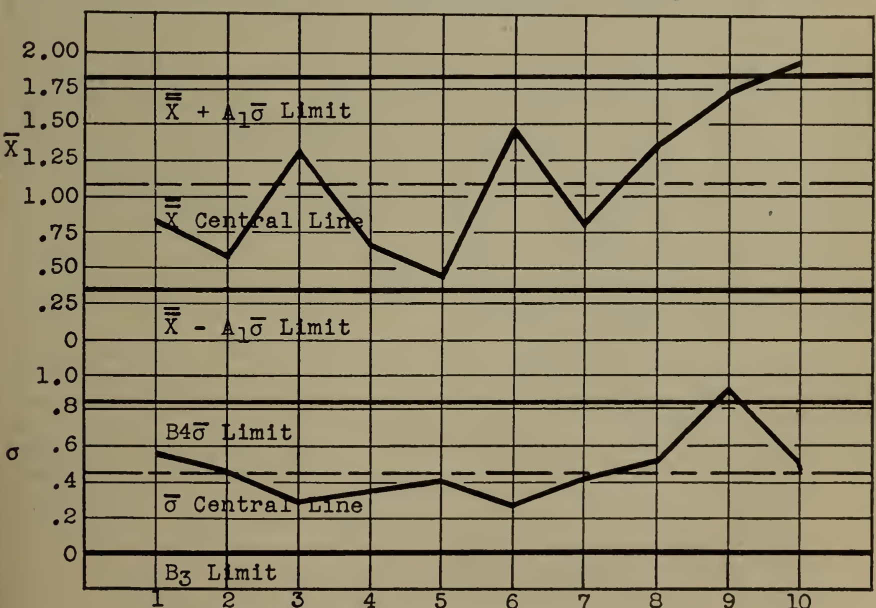

Fig. 2. Control Chart for Data in Table IV

From an inspection of the control chart for means, it becomes obvious that Subgroup 10 represents test results which do not conform to the limits as established for the data; that is, Subgroup 10 has a mean value deviating from the expected values by an amount greater than that assignable to chance alone. It will be further noted that the standard deviation for Subgroup 9 differs from the upper limit by a significant amount, even though the mean for the subgroup is within limits. In general, it is not necessary for both statistics to be outside the limits before looking for assignable causes for such departures. From the values tabulated and plotted, several observations are possible.

1. An upward trend in shrinkage is indicated by the means for Subgroups 8, 9, and 10, with 10 having a mean beyond the calculated upper limit. This trend can be taken as an indication of developing lack of control, and the operations involved should be checked.
2. The standard deviation for Subgroup 9 is greater than the calculated upper limit. As the standard deviation is a measure of the variation existing in the test data, a large standard deviation value can only be obtained when large variations exist in the data. Thus, this subgroup indicates operations which have resulted in a very erratic finishing of the fabric involved, making a review of the actual steps advisable.
3. While the mean for Supgroup 10 is beyond the calculated upper limit, the standard deviation is not, therefore, the uniformity of the results is satisfactory, however, the central measure of these results has shown a shift greater than that assignable to chance alone, and the cause for such a shift should be investigated.

While this is but one example of the application of statistics to quality control operations, space prohibits discussing the fields of control by means of fraction defective and with standard of compliance given, and the use of the control chart as a sampling index or in the development of operational and buying and selling specifications.

Consider now another aspect of this finishing problem, namely that of the effect of the new finish on the fabric properties as compared to the old finish or to the fabric prior to finishing. The usual procedure is to run a series of tests, such as breaking strength, on suitable samples of the fabric prior to finishing, fabric with the old finish, and fabric with the new finish, after which the data are subjected to some form of evaluation. The common practice is to devise rather elaborate methods for the collection of the data, yet but the most elementary evaluation is employed, the data being scanned by the proper individual, an average value or two calculated, and a decision rendered. If the proposed changes are of considerable magnitude, a conference may even result, however, little consideration has been given to the basic problem of how do the test data compare on a statistical basis. It is true that the individual making the decision usually has had considerable experience in such work, however, at best this decision is merely a good guess based on his experience, while it can be an expensive mistake.

In the light of what has been said, all that is involved in the statistical analysis of such data is the comparison of the statistical populations represented by the two treatments and the untreated fabric, and a decision as to the correlation existing between them; high correlation indicating no difference, and low correlation existing considerable difference. Of a number of statistical tests which may be used to provide such a comparison, the L_0, L_1, and F tests are of considerable value, as they are relatively easy to apply, and the application of each involves little additional calculation other than that necessary for the application of any one of them.

In using these tests, the term VARIANCE is employed as a measure of the distribution or uniformity of the data, and mathematically speaking, variance is defined by the following formula:

$$s^2 = \frac{\Sigma X^2}{n} - \bar{X}^2 \qquad (5)$$

wherein s^2 is the variance of a group of observations, ΣX^2, n, and $\bar{X}^2$ are as have been previously defined.

In the problem at hand, it was established that the effect of the finishing treatments could be evaluated by single strand strength-elongation tests. Accordingly, a total of 40 single strand strength-elongation tests were made by means of an incline plane testing machine on the samples from each fabric. The arithmetic means and minimum-maximum values are given in the following table.

Table VI. Means and Minimum-Maximum Values Per Fabric

Statistics	STRENGTH RESULTS, GRAMS Untreated Fabric	Treatment A	Treatment B	ELONGATION RESULTS, % Untreated Fabric	Treatment A	Treatment B
MEAN VALUES	100.9	102.3	103.5	8.1	8.2	12.6
MINIMUM TEST	82.5	83.0	91.5	11.0	10.5	8.5
MAXIMUM TEST	112.0	108.5	112.0	24.4	20.0	21.5

The question to be answered is whether or not the fabrics have strength and/or elongation characteristics differing appreciably from fabric to fabric. The L_0, L_1, and F tests will supply answers along the following lines:

1. Could the test results for the three fabrics belong to normal populations having the same mean and the same variance? (The L_0 test.)
2. Could they belong to normal populations of the same variance, no stipulations being made as to the mean? (The L_1 test.)
3. Could they belong to normal populations whose means are appreciably the same and whose variances are assumed the same? (The F test.)

It will be observed that L_0 tests for the existence of homogeneity, whereas both L_1 and F test for the nature of any non-homogeneity shown to exist by the L_0 test, i.e., whether the difference is one of means or of variances. If, statistically speaking, it is shown by the L_0 test that the three fabrics belong to normal populations having the same mean and the same variance, then the fabrics are alike with respect to the strength-elongation tests. If the L_0 test is not supported, but the L_1 test is, then it follows that the fabrics differ, this difference consisting of an actual shifting of the central tendency measure of the populations without affecting the distribution of the results. The F test, on the other hand, is designed to measure the lack of uniformity or the variance existing, thus, if the L_0 and L_1 tests show significant differences, these differences must be in the nature of more or less uniformity. Actually, the application of the F test after the L_0 and L_1 tests is seldom necessary except as confirmation.

The L_0 and L_1 functions as devised by Neyman and Pearson, and as given by Freeman are as follows:

$$L_0 = \left(\frac{s_1^2 \cdot s_2^2 \cdot \cdot \cdot s_k^2}{s_0^2 \cdot s_0^2 \cdot \cdot \cdot s_0^2} \right)^{\frac{1}{k}} \qquad (6)$$

$$L_1 = \left(\frac{s_1^2 \cdot s_2^2 \cdot \cdot \cdot s_k^2}{s_a^2 \cdot s_a^2 \cdot \cdot \cdot s_a^2} \right)^{\frac{1}{k}} \qquad (7)$$

In computing (6) and (7), the geometric mean s_g^2 of the within sample variances s_1^2 is introduced, as follows:

$$s_g^2 = \left\{ s_1^2 \cdot s_2^2 \cdot \cdot \cdot s_k^2 \right\}^{\frac{1}{k}} \tag{8}$$

then

$$Lo = \frac{s_g^2}{s_0^2} \tag{6a}$$

$$L1 = \frac{s_g^2}{s_a^2} \tag{7a}$$

where

$$s_0^2 = \frac{\Sigma_1^{nk}\left(X-\bar{X}\right)^2}{n} \tag{9}$$

$$s_a^2 = \frac{\Sigma_1^k \; s_i^2}{k} \tag{10}$$

$$N = nk \tag{11}$$

wherein k is the number of fabrics involved (3),
n is the observations made on a fabric (40),
N is the total number of observations made for all fabrics (120),
s_1^2 is the within fabric variances,
s_0^2 is the variance based on the deviation of all N observations about their mean $\bar{X}$,
s_a^2 is the mean of the within sample variances.

For the data under consideration herein, the values of the various statistics are as follows:

STATISTIC	FOR STRENGTH RESULTS	FOR ELONGATION RESULTS
s_0^2	29.0	18.5
s_a^2	25.9	7.9
s_g^2	24.3	7.9
L_0	0.84	0.43
L_1	0.94	1.0
n	40	40
k	3	3

The values for L_0 and L_1 tend to unity if the hypotheses that the populations under consideration have the same mean and same variance (L_0 test) or the same variance without regard to the mean (L_1 test) is upheld, and tend to 0 if they are not upheld. Tables have been prepared covering the distributions of L_0 and L_1 for probabilities of 5 per cent and 1 per cent for various values of k and n, for the occurrence of unity is highly unlikely even if the hypotheses are true. The distribution values for 3 samples of 40 observations each from such tables for a probability of 5 per cent are 0.9216 for L_0 and 0.9495 for L_1, while for a probability of 1 per cent they are 0.8922 and 0.9234 respectively. In textile work, experience has indicated that a probability of less than 5 per cent can be taken as showing the existence of a significant difference between the groups of data under consideration. Thus, the L_0 test for strength and elongation both indicate a probability of less than 1 per cent that the data under consideration could have come from populations having the same mean and variance, with the elongation L_0 value indicating extreme difference. The L_1 test values, on the other hand, show no significant differences between the groups (0.94 for strength is sufficiently close to the 5 per cent level for such a conclusion for all practical purposes). That is, the three fabrics belong to normal populations having the same variance.

While the application of the F test to the data is not necessary in view of the above results, its application will serve as a confirmation of these results. Also, it is frequently possible to apply an F test only to experimental data and obtain the necessary statistical support for a decision. The value for F tends to unity if the hypothesis that the fabrics belong to normal populations whose means are appreciably the same and whose variances are assumed the same is upheld, and tends to be larger than unity if not upheld. The distribution of F has been calculated, and tables prepared for 5 and 1 per cent levels as for L_0 and L_1. In practice, the F test consists of the ratio obtained by comparing the variances existing within the results for each fabric to the variance existing among the results for all the fabrics, and this comparison takes the following final form.

Table VII. Application of the F Test

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares
Among Fabrics	$\Sigma\bar{X}_c^2 - n\bar{X}^2$	k—1	$\dfrac{\Sigma\bar{X}_c^2 - n\bar{X}^2}{k-1}$
Within Fabrics (Error)	$\Sigma X^2 - \Sigma\bar{X}_c^2$	n—k	$\dfrac{\Sigma X^2 - \Sigma\bar{X}_c^2}{n-k}$

$$F = \frac{\Sigma\bar{X}_c^2 - n\bar{X}^2}{k-1} \div \frac{\Sigma X^2 - \Sigma\bar{X}_c^2}{n-k}$$

wherein $\bar{X}$ is the mean value of all the observations made,

$\Sigma\bar{X}_c^2$ is the sum of the fabric mean values squared and multiplied by the number of observations made in each group,

k is the number of fabrics involved (3),

n is the total number of observations made for all fabrics (120).

For the data reported herein the values of the various statistics are as follows:

STATISTIC	FOR STRENGTH RESULTS	FOR ELONGATION RESULTS
$\bar{X}$	102.22	16.97
$\bar{X}^2$	10449.81	277.98
ΣX^2	1257453.3	35698.6
$\Sigma \bar{X}_c^2$	1254336.0	34748.0
$n\bar{\bar{X}}^2$	1253977.0	33357.6
F	6.78	96.8

The distribution value for F for 3 and 117 degrees of freedom for a probability of 5 per cent is 3.07, while for 1 per cent it is 4.78. That is, for a 5 per cent probability that the test data for the three fabrics could have come from populations having appreciably the same means and variances assumed the same, the value for F would have to be 3.07. The calculated values for F indicate that there is considerably less than one chance in a hundred that the test data could have come from such populations.

On the basis of the L_0, L_1, and F tests, the only possible conclusion with respect to the three fabrics is that they differ with respect to the strength-elongation test results, this difference taking the form of shifting the means without affecting the variances, i.e., the fabrics have not altered with respect to the uniformity of tests results. This is especially noticeable in the elongation results. While it may be argued that inspection of the results tabulated in Table VI would reveal this to the experienced individual without the need for the work involved in the computation of the various tests applied, nevertheless it cannot be denied that the statistical results supply a form of proof outside, beyond, and independent of any intuitive reasoning on the part of the experienced individual, and it is herein that the value of statistics as a tool lies.

While it is beyond the scope of such a paper as this to reveal the full extent to which an understanding of statistical principles can be of value in manufacturing operations, it is nonetheless hoped that some inkling of this value has been transmitted, and that the desire for further knowledge has been awakened.

Following is a brief listing of reference which may be of interest.

1. ASTM Manual on Presentation of Data, Including Supplements A and B. Published by ASTM, Philadelphia, 1945, Pp. IX, 73.

   Supplement A covers ± limits of uncertainty of an observed average and is designed to discourage engineers in their traditional use of probable error as a measure of the reliability of an observed average. Supplement B covers control chart method of analysis and presentation of data, and while it does a good job of explaining how to make a control chart, it is too brief to explain when or why.

2. Guide for Quality Control and Control Chart Method of Analyzing Data, Z1.1-1941, Z1.2-1941, and Control Chart Method of Controlling Quality During Production, Z1.3-1942. Published by American Standards Association, New York, 1941 and 1942. Pp. 15, 47-66 and 41.

   Considerable reference is made in these to the ASTM Manual. The quality control procedure discusses such questions as what data to gather,

how to collect and group it, and how to treat the data to get the appropriate control chart. Z1.3 shows considerable overlap with respect to the first booklet covering Z1.1 and Z1.2, however Z1.3 is better organized for use in practice.

3. Examination of Industrial Measurements, by John W. Dudley, Published by McGraw-Hill Book Co., Inc., 1946. Pp. IX, 113.

   An excellent book for the beginner in the field of statistical quality control, or for the executive desiring a speaking acquaintance with the field. Well and clearly written, with special emphasis on broad industrial applications. Covers types of industrial data, random variation, method of presenting data, normal probability curve, the quality control chart, correlation and curve fitting, and related information.

4. Industrial Statistics, by H. A. Freeman. Published by John Wiley & Sons, Inc., New York, 1942, Pp. IX, 178.

   A book for the advanced student in the field of analysis of data by various means. Well illustrated by practical examples, and with considerable notation relating to the mathematical theory involved. Covers difference of two means, differences among several means, relationship among variables, systematic quality control, sampling and the risks of producers and buyers, and tables for probability points of $\sqrt{b_1}$, B_2, a, normal distribution areas, t, x^2, F, L_0, and L_1.

5. Statistical Quality Control, by Eugene L. Grant. Published by McGraw-Hill Book Co., Inc., New York, 1946. Pp. XII, 563.

   This book was written from the viewpoint of providing a working manual covering simple but powerful statistical techniques that can be widely used in industry to reduce cost and improve product quality. Theory is limited to that necessary to supply practical working rules. A well recommended book for those engaged in quality control work or contemplating such work.

6. Economic Control of Quality of Manufactured Produce, by W. A. Shewhart. Published by D. Van Nostrand Co., Inc., 1931. Pp. XIV, 501.

   The book by the originator of the quality control chart technique. A fundamental work from which all control chart technique has stemmed, and with this, enough has been said.

7. Industrial Quality Control, monthly magazine published by American Society for Quality Control, New York.

   This publication covers all phases of industrial quality control, and is received by members of the Society.

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HISTORICAL SKETCH OF THE LOWELL TEXTILE INSTITUTE

The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, culminating a movement for the establishment of the School initiated June 1, 1891. On January 30, 1897, the School was formally opened by Governor Roger Wolcott in rented quarters in the heart of the city. It was not until January 1903, that Governor John L. Bates dedicated the first building of the present physical plant.

In accordance with the acts of incorporation, the school functioned as a private institution, with state aid, under the authority of a Board of Trustees consisting of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the schools of Lowell, and a representative of the Textile Council were members ex-officio. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees for periods of four years each.

In 1918, by virtue of a decision forced by the passage of the anti-aid amendment to the State Constitution, forbidding state aid to private schools, the property of the school was transferred to the Commonwealth of Massachusetts on July 1 of that year, and the control and management of the school was vested in a Board of Trustees appointed by the Governor.

In 1928, by virtue of legislative act, Lowell Textile School became known as Lowell Textile Institute in order to define more clearly the standing of the institution.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textiles and kindred branches of the industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

During the early years of the Institute, in keeping with its initial educational objective, no degrees of any kind were offered and all graduates received diplomas upon the satisfactory completion of their work.

However, the passage of years since the establishment of the Institute has seen many fundamental changes in the industry and its relationship to society. New fibers, new machinery, new auxiliary materials, new merchandising techniques . . . all have followed one another in bewildering array. The dynamics of social behavior, the changing position of labor, the shifts in international competition concomitant with shifts in foreign policy, all have tended to re-focus our attention on new educational objectives, with lesser emphasis on the purely vocational aspects of our program. The challenge of world events, integrating as they have the multiplicity of man's knowledge in the humanities as well as the sciences, has made change inevitable and desirable in the traditional patterns of the curricula at Lowell Textile Institute.

Thus, in 1913, the Institute granted its first degrees, the Bachelor of Textile Engineering (B.T.E.) and the Bachelor of Textile Chemistry (B.T.C.). In 1946, these degrees were further modified to more clearly reflect the scope and quality of the undergraduate program and the class of 1947 was the first to receive the

Bachelor of Science (B.S.) degree from Lowell Textile Institute. The specialized diploma courses have been discontinued and all of the vocational training placed in the night school program, described in a separate bulletin.

In making these curricula changes, the administration has kept clearly in view the fact that the Institute is training its students to enter the textile and related industries. The mechanical equipment of the Institute includes the best makes of textile machinery and the students continue to receive considerable instruction in the handling and manufacture of the various textile fibers. However, the fundamental educational basis for this manufacturing program has expanded along lines found successful in engineering colleges throughout the country, and includes a diversified corps of courses in English, Social Sciences, and the Physical Sciences, as well as a nucleus of Engineering and Applied Chemistry courses, which attempt to integrate the fundamental and applied points of view. All curricula are based on the notion that the college program cannot train adequately the specialist; it can only predispose the student's thinking along special lines, giving him a broad basis from which to develop further an imaginative point of view, a tolerant, questioning attitude, and certain ethical values governing his relationships with other men.

The administration and faculty at Lowell Textile Institute regard the curricula as dynamic, experimental concepts and constantly are seeking for new educational methods capable of better meeting the challenge posed by the instability of modern world society. This objective will be kept constantly in view, and as new demands are presented, every effort will be made to extend courses, equipment, and floor space.

COEDUCATIONAL

Within the last few years the possibilities for women in certain branches of the textile field have become recognized and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some, for it offers a broad training that prepares for many lines of activity. For those who wish to specialize in textile designing and art, the Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

BUILDINGS, GROUNDS, AND EQUIPMENT

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Textile Avenue, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Com-

pany of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department, the Woolen and Worsted Yarn Department, the Department of Synthetic Textiles, and contains on the lower floors equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three-story addition was placed on a single-story building that was previously known as the Colonial Avenue Building which was erected in 1910. This Hall contains on the first floor the Cotton Finishing laboratory with classrooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry, Textile Coloring, and Finishing Department.

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will be further improved to make a modern athletic field for baseball and other sports.

The equipment in the various buildings is extremely varied and includes textile machinery covering all of the basic systems for handling staple and continuous filament fibers from raw material to finished fabric. The textile equipment is closely integrated to modern laboratories in physics, chemistry, engineering, chemical, physical and optical testing. In all cases, including those machines which are exact replicas of commercial models, the various laboratories are geared to both teaching and research.

Dormitories. Modern, attractive living quarters are available for 112 students in Smith Hall, dedicated in April, 1948, in honor of James T. Smith, pioneer educator in the textile field and the man primarily responsible for the organization of Lowell Textile Institute.

A second dormitory, which will house an additional 112 students is under construction and will become available late in 1948. For further information concerning the dormitories, write directly to the Office of the Dean.

Library and Reading Room. That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain books in a wide variety of fields of interest, with an emphasis on textiles, art, chemistry, and engineering. All of the significant scientific journals in textile and allied fields are available, as well as journals of general interest.

Plans are under way for a new library building which will greatly expand the study and reference facilities available.

SPECIAL SERVICE

In recognition of the unique research opportunities afforded to the textile industry by virtue of the equipment and staff available at Lowell Textile Institute, the Institute has been authorized by the Massachusetts State Legislature to conduct research, development, and consulting programs under contract to responsible agencies. This activity has the effect of permitting staff members access to new and significant developments in the textile and allied industries and materially assists in keeping the teaching programs current and dynamic.

ADMISSION

As the number of applications for admission to Lowell Textile Institute far exceeds the number that can be admitted, the Faculty Committee on Admissions endeavors to select as wisely as existing standards of measurement permit, those candidates who, during their preparatory education, have shown evidences of promise in scholastic ability, strength of character, and leadership.

Candidates for admission should submit their applications on the form which may be found as the last page of this Curriculum Bulletin. *Applications should be sent to the Registrar of the Institute as early as possible after the conclusion of the candidate's junior year of secondary school.*

Fulfillment of prescribed requirements does not automatically constitute the acceptance of a candidate. The final decision as to the eligibility of an applicant shall be left to the discretion of the Faculty Committee on Admissions.

The conditions under which an applicant may be accepted are as follows:

I. A Candidate for Admission must be a Graduate of a Secondary School Approved by the New England Entrance Certificate Board, the Regents of the State of New York, or a Board of Equal Scholastic Standing.

II. Because of the Specialized Nature of the Various Curricula at Lowell Textile Institute, It Has Been Deemed Advisable to Require that All Entering Students Shall Have Completed the Following Units of Secondary School Study:

	Prescribed Subjects	*Electives*
2 units	Algebra (quadratics and beyond)	Language other than English
1 unit	Plane Geometry	History other than American
4 units	English	Mechanical Drawing
1 unit	American History	Solid Geometry
1 unit	Chemistry (including laboratory)	Scientific Subjects
1 unit	Physics (including laboratory)	Advanced Algebra
½ unit	Trigonometry	Social Studies
5 units	Electives	
15½ units		

A unit of preparatory credit is the equivalent of one secondary-school subject satisfactorily pursued during one academic year of at least thirty-six weeks of four forty-minute meetings each week or the equivalent.

III. Scholastic Aptitude Test and Achievement Tests

Experience has shown that the Scholastic Aptitude Test and Achievement Tests, given by the Educational Testing Service, are very valuable guides in determining fitness for college.

All Candidates for Admission to Lowell Textile Institute Must Take the Tests Noted Below. Results of these Tests Will Be Utilized for Guidance Only.

It is required that all applicants take these tests no later than December of the year preceding that in which they desire admission. Application to take the tests should be made at least three weeks before the scheduled date of the tests. Application forms for these tests may be procured from the Educational Testing Service, P.O. Box 592, Princeton, New Jersey.

These examinations are given at various cities, so that no applicant should be placed under undue hardship in taking the tests. *It is the full responsibility of the applicant for admission to Lowell Textile Institute to arrange for and complete these tests.*

All students should take the Scholastic Aptitude Test and Intermediate Mathematics Test, Program 2 in the Bulletin of the Educational Testing Service,

and Program 4, taking Achievement Tests in Social Studies, Chemistry and Physics.

IV. Extra-curricular Activities

Recognition is given to the desirable effect on a student's attitude and personality of participation in athletics and other types of student activities in the secondary school and in the community. Such extra-curricular activity is not required of entering students, nor will it substitute for a good scholastic record. However, the Faculty Committee on Admissions will carefully evaluate it along with the scholastic record in accepting or rejecting an applicant.

V. Recommendations

It is important that each applicant carefully select the three persons submitting letters of recommendation in order to assist in presenting an all-round evaluation of the applicant. Not more than one letter is to be written by a person in the educational field. These letters must not be given to the applicant, but must be sent directly to the Registrar of the Institute.

EXCEPTIONS TO ADMISSION RULES

In special cases, at the discretion of the Faculty Committee on Admissions, applications for admission may be accepted from candidates in the following categories:

A. If a candidate has not maintained a uniformly good scholastic average in all subjects *but is otherwise acceptable*, the Faculty Committee on Admissions reserves the right to require the applicant to pass the examinations of the Educational Testing Service, in those subjects as it may deem necessary, in addition to or in substitution of the tests required as listed in Condition III for Admissions.

No examinations for admission shall be given by the Institute.

B. A candidate from any school not on an accredited list shall be required to pass the examinations of the Educational Testing Service in those subjects prescribed by the Faculty Committee on Adminissions, in addition to or in substitution of the tests required as listed in Condition III for Admissions.

ADVANCED STANDING

An applicant shall be given credit for those subjects satisfactorily completed at a university or a college which meets the requirements of the Institute. A candidate to receive such credit must make application for such, either at the time that his record is submitted for consideration or not later than the day of registration.

Candidates may be admitted to advanced standing beyond freshman status, by submitting their records of previous college training at the time of application. While every effort will be made to grant acceptable applicants for advanced standing full credit for previous college and/or military training courses, the final decision in this matter will rest with the Head of the Department concerned.

REGISTRATION

Freshman — Each freshman is expected to be in daily attendance beginning September 8, at 9:30 a.m., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests

are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Upperclassmen — All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the mid-year examination period. For unexcused delay in registration a fee of $5 will be imposed.

THE GRADUATE SCHOOL

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete a program of advanced standing.

The object of these programs is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to the textile industry.

I. *General Admission*

An applicant for admission as a Graduate Student must present evidence that he is the holder of a Bachelor's degree in an acceptable four-year course in the pursuance of which he maintained a uniformly high scholastic rating. He must also be prepared to submit statements, from persons qualified to judge, that in their opinion he has the ability to pursue graduate work. *Applications for admission to the Graduate School should be made no later than April 15.*

II. *As a Candidate for an Advanced Degree*

Admission to the Graduate School does not indicate that the student is a candidate for the Master's Degree. Application for approval of candidacy for the advanced degree must be filed with the Department Head after the completion of one term of residence and no later than twelve weeks prior to the date on which the degree is to be conferred.

III. *As a Provisional Graduate Student*

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (I) may be accepted provisionally, provided he satisfied the department in which he wishes to enroll that he is probably able to pursue graduate studies successfully.

The status of such a student will be changed to that of a Graduate Student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of 3.5 (80%).

IV. *Requirements for Graduation*

To be recommended for the Master of Science degree a student must have fulfilled the following requirements:

a. Completed a course of study approved by the Department in which he has been enrolled.

b. Completed a thesis (original research or other investigation, optional with Department) approved by the Department in which he has been enrolled.

c. Residence of at least one academic year.

d. An average rating of 3.5 (80%) in those courses submitted for graduate credit. All courses submitted for graduate credit, which are normally upperclass undergraduate courses (those offered to juniors and/or senior students), must be passed with a grade of 80% or better.

The exact nature of each student's program will be worked out in cooperation with the major professor and approved by the Head of Department. Every attempt will be made to keep such programs flexible and in keeping with the student's educational objectives.

A graduate of Lowell Textile Institute, or one with equivalent training, can usually complete the work for the Master's degree in one year, provided he continues his major studies in the same field in which he majored as an undergraduate. Other students, or those who change their educational emphasis, will require a longer time, usually two years, according to the number of prerequisite subjects which must be taken.

Special work may be done in the Graduate School, by arrangement with the Graduate School Committee, by individuals not seeking an advanced degree, but who wish to take special subjects or to conduct research to which the facilities at Lowell Textile Institute may be peculiarly adapted. Candidates seeking such status must meet the requirements for General Admission to the Graduate School, as noted above.

TUITION AND FEES

Tuition Fee. — The fee for the day course is $150 per year for residents of Massachusetts, and $250 per year for non-residents. The fee for students from foreign countries is $500 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the President for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee. — An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Publication Fee. — A publication fee of $7 is due and payable at the first payment of tuition.

Deposits. — Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Board and Rooms. — If space is not available in the dormitories, students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $15 per week and upwards.

Books and Materials. — Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause to machines, laboratory equipment, and other property of Lowell Textile Institute.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (residents of other countries)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Publication fee	7
Machine shop deposit	10
General breakage fee (This applies to students who do not take chemistry or machine shop)	10
Books and supplies (Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50

SCHOLARSHIPS, PRIZES, AND LOANS

SCHOLARSHIPS. — A limited number of scholarships are available at Lowell Textile Institute through funds variously contributed by the textile and allied industries.

1. *New England Textile Foundation Undergraduate Scholarships*

Scholarships of $500 per year are available by means of competitive examination, to students who qualify for entrance to Lowell Textile Institute under the terms described in the ADMISSION section of this Bulletin. *All students interested in competing for one of these awards should make application directly to the New England Textile Foundation, 68 South Main Street, Providence, Rhode Island, no later than January 15, 1949.* Detailed instructions and the necessary application forms will be sent to each applicant accepted for the competition.

2. *New England Textile Foundation Graduate Fellowships*

A limited number of graduate fellowships are available to eligible candidates through funds created by the New England Textile Foundation. *Applicants should write directly to the New England Textile Foundation, 68 South Main Street, Providence, Rhode Island, no later than January 15, 1949.*

3. *Berkshire Fine Spinning Associates, Inc., Scholarships*

A number of scholarships covering tuition and living expenses for four years are offered in Textile Engineering and Cotton Manufacturing by the Berkshire Fine Spinning Associates, Inc., Providence, Rhode Island. Eligible applicants are:

a. Male employee of Berkshire Fine Spinning Associates, Inc., who have had adequate secondary school training.

b. High school graduates who are sons of present employees.

Interested students should contact the Berkshire Fine Spinning Associates, Inc., Turks Head Building, Providence 1, Rhode Island.

4. *Chicopee Manufacturing Corporation Scholarships*

Two scholarships for junior students in Textile Engineering or Cotton Manufacturing are offered by the Chicopee Manufacturing Corporation.

The scholarships provide $600 per academic year to residents of Massachusetts and $700 for out-of-state residents. Candidates must be native-born citizens of the United States, with potentialities for both leadership and scholarship. Preference is given to native New Englanders and to those who agree to work summers in approved cotton mills. Each award will be of two years' duration.

5. *Goodall-Sanford, Inc., Scholarships*

Goodall-Sanford, Inc., Sanford, Maine, offers to eligible employees of the company full four-year scholarships, the recipient to receive income at the rate enjoyed by the candidate while in the employ of the company. Successful candidates may choose any textile school certified by Goodall-Sanford, Inc., Lowell Textile Institute being one of these approved schools.

6. *Joseph P. Kennedy Graduate Fellowships*

A trust fund, in memory of Joseph P. Kennedy, Jr., has been created by Mr. Joseph P. Kennedy, former Ambassador to Great Britain, making available two teaching fellowships of $600 per academic year in textile engineering or textile chemistry.

7. *Koppers Company, Inc., Graduate Fellowship*

The Koppers Company, Inc., Pittsburgh, Pennsylvania, offers a graduate fellowship in chemistry to stimulate investigation of various chemicals as textile aids. The fellowship provides for $1,000 per academic year, $500 additional for materials and supplies, and certain funds for other miscellaneous expenses incurred during the research.

8. *Pacific Mills Worsted Division Overseers Association Scholarships*

Several $500 scholarships are supported by the Overseers Association of the Pacific Mills Worsted Division, Lawrence, Massachusetts. The Overseers Association selects qualified candidates, who must then meet with the approval of the Admissions Committee of Lowell Textile Institute.

9. *United Elastic Corporation Scholarships*

Two $500 scholarships are available through the United Elastic Corporation, Easthampton, Massachusetts.

These scholarships have been established primarily for employees of United Elastic Corporation, or members of their families. However, other residents of the community may enter applications for consideration.

Qualifications for scholarships include: Four years of high school education or its equivalent; residence in Massachusetts; good character and standing in the community; aptitude for technical training; ability to pass entrance requirements of Lowell Textile Institute.

Granting of a scholarship shall be for a one-year period and further extension will be made in accordance with the initiative and progress by the student during the year. The United Elastic Corporation will, so far as possible, furnish suitable employment to the student during the summer vacation period and following vacation.

All applications should be made through the plant nearest to residence of applicant. Applications from the Littleton area should be made to Dana Norris, personnel manager of Conant-Houghton division, Littleton Common, while Lowell area applicants should apply to Andrew C. Jenkins, personnel manager, United Elastic Corporation, Lowell.

10. *Warwick Chemical Foundation in Memory of Walter Nowicki*

Through funds made available by the Warwick Chemical Foundation in memory of Walter Nowicki, scholarships are offered to students in Chemistry at both the undergraduate and graduate levels. This memorial fund was created by the Warwick Chemical Company in memory of Walter Nowicki, an employee of the company who lost his life in the armed services during World War II.

11. *Alumni Association Scholarships*

Scholarship funds under the care of the Alumni Fund Council make available one scholarship a year which covers tuition and miscellaneous fees.

Application should be made through the Alumni Office, Lowell Textile Institute.

Prizes .— The following prizes are awarded annually:

The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who maintains the highest standing throughout his course in Textile Engineering (General or Cotton Option) or the course in Cotton Manufacture.

The Proprietors of the Locks and Canals on the Merrimack River Scholarship at Massachusetts Institute of Technology. — Several years ago the Proprietors of the Locks and Canals on the Merrimack River, a corporation owning the power rights on the Merrimack River in Lowell, gave to the Massachusetts Institute of Technology a sum of money to provide graduate scholarships to graduates from the Lowell Textile Institute who held a degree and were recommended by the trustees. Applicants must have maintained throughout their undergraduate courses a high scholastic record and must meet the requirements of the Graduate School of the Massachusetts Institute of Technology.

Louis A. Olney Book Prizes. — Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:

$10 to the student graduating from the Chemistry and Textile Coloring course, who, not having already received recognition by appointment as an assistant instructor, shall have maintained the highest scholarship through the course.

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year.

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year.

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry.

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry.

Phi Psi Award. — This award is given annually to an outstanding member of the Senior Class on the basis of scholastic standing, leadership, initiative, personality, loyalty, and courtesy.

The award is a pocketbook and leather case set made of ostrich leather and lined with calfskin. Inside each article is embossed the coat of arms of the Phi Psi Fraternity, also the recipient's name printed in gold. In addition, the graduating student receiving this award is presented with a suitably engraved certificate, certifying that this honor has been given him.

Student Loan Fund. — A loan fund is available to needy students through the Lowell Textile Associates, Incorporated. Students may make application for a loan through the Faculty Loan Committee. Repayments on any loan which are made while the student is still in school are interest free. Loans repaid after the student leaves school (for whatever reason) bear 4% interest beginning six months after the date at which the student officially leaves school. Repayments are *not required* until the student separates from Lowell Textile Institute, at which time repayments are due quarterly at a rate of $5.00 per quarter the first year and $10.00 per quarter each year thereafter until the loan is repaid.

Additional payments can be made at any time so as to reduce indebtedness at a more rapid rate.

GENERAL REGULATIONS

ATTENDANCE. — The responsibility for attending classes rests largely with the student. Attendance is expected of all students at all classes. Any absence from classes in excess of one week will be subject to investigation unless previously justified. Prolonged, unexplained absences will be reported to the student's family and may be considered grounds for dismissal from the Institute.

FACULTY ADVISERS. — Each freshman and sophomore will have a faculty adviser, to be of such aid and assistance as is possible both during and after school hours. Academic counseling is voluntary on the part of the student, but students are strongly urged to use their advisers as a means of becoming oriented to the college program and to facilitate the selection of major fields of study. The faculty adviser will be appointed during registration.

The head of the department will function as primary adviser to upperclass students (juniors and seniors).

The Office of the Dean is open to all students at all times to assist the student in attaining his academic objective and to assure his active, enjoyable participation in the social life of the Institute.

MARKING SYSTEM. — A student's work in any course will be marked according to the following definitions:

Number	*Letter*	*Rate Value*
90–100	H	5
80– 89	C	4
70– 79	P	3
60– 69	L	2
50– 59	F	1
0– 49	FF	0
D (Deficient)		

F grade permits re-examination to raise grade to L

D grade indicates that final mark is withheld pending completion of basic requirements of course

Credit Hours, which are the basis for graduation, are assigned to each course. The value in credit hours for each course given at Lowell Textile Institute is shown with each course description later in this bulletin.

Cumulative Point Average, upon which honor and probationary status depend, is calculated as follows:

Each letter is assigned the rate value indicated above. A total obtained by adding together the number of lectures and/or recitations, laboratory periods (if any), and hours of preparation, is multiplied by the rate value of the letter. This gives the revised value, which must be obtained for each subject. The sum of the revised values is divided by the sum of the units. This result is the term rating.

EXAMPLE

Lect.	*Lab.*	*Prep.*	*Units*	*Grade*	*Rate*	*Revised Rate*
4	3	4	11	H	5	55
1	5	0	6	P	3	18
3	0	5	8	C	4	32
5	0	7	12	L	2	24
4	1	5	10	C	4	40
2	0	2	4	H	5	20
			51			189

$$\frac{\text{Sum of Revised Value}}{\text{Sum of Units}} = \text{Term rating}$$

$$\frac{189}{51} = 3.70$$

Probation. — Ordinarily, a student will not be dropped from the Institute without previous notice to the student and his family of the possibility of such action. If the record of the student is so poor that every indication points to his inability to proceed further with the college program, he may be requested to leave school at a given time. If the record of the student shows some promise, but demands an improvement in order to meet academic requirements, he will be placed on probation.

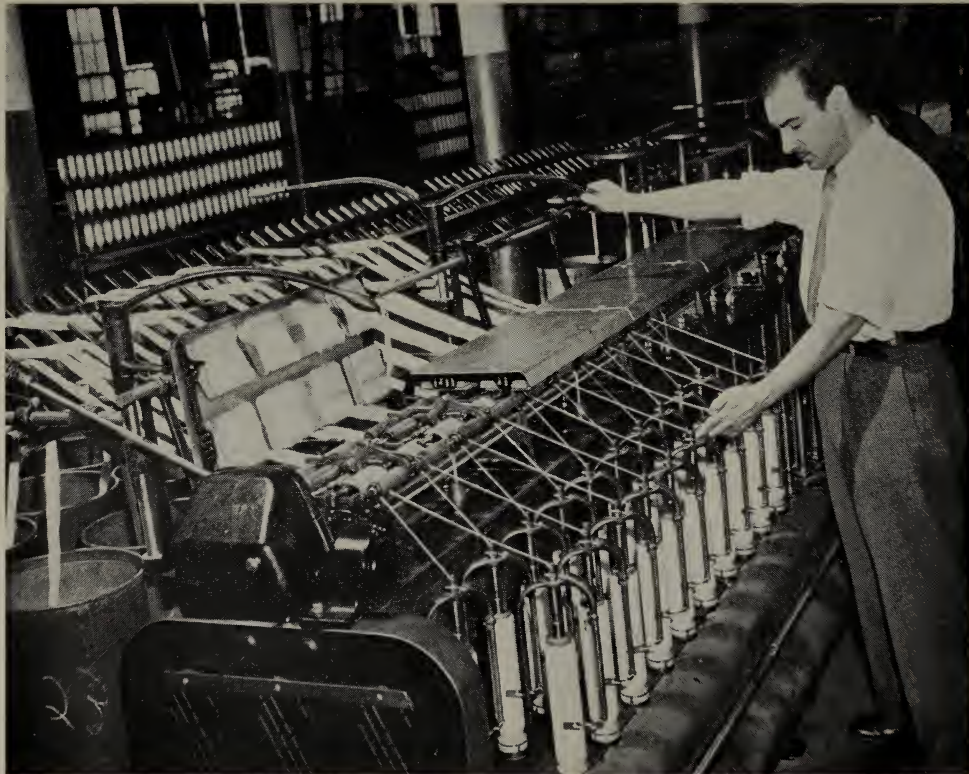
If a student is placed on probation, the probationary period constitutes the entire semester following the issuance of the probationary status, and a student, to continue school, must bring his point average to 2.25 or better during this period.

Probationary status implies: (1) that failure to raise his grade to 2.25 or better will, except under unusual circumstances, result automatically in dropping the student from school, (2) that while on probation, a student may not represent the Institute in any public function, (3) that while on probation, a student may not hold class or other offices which will require a significant portion of his time without the specific consent of the Dean.

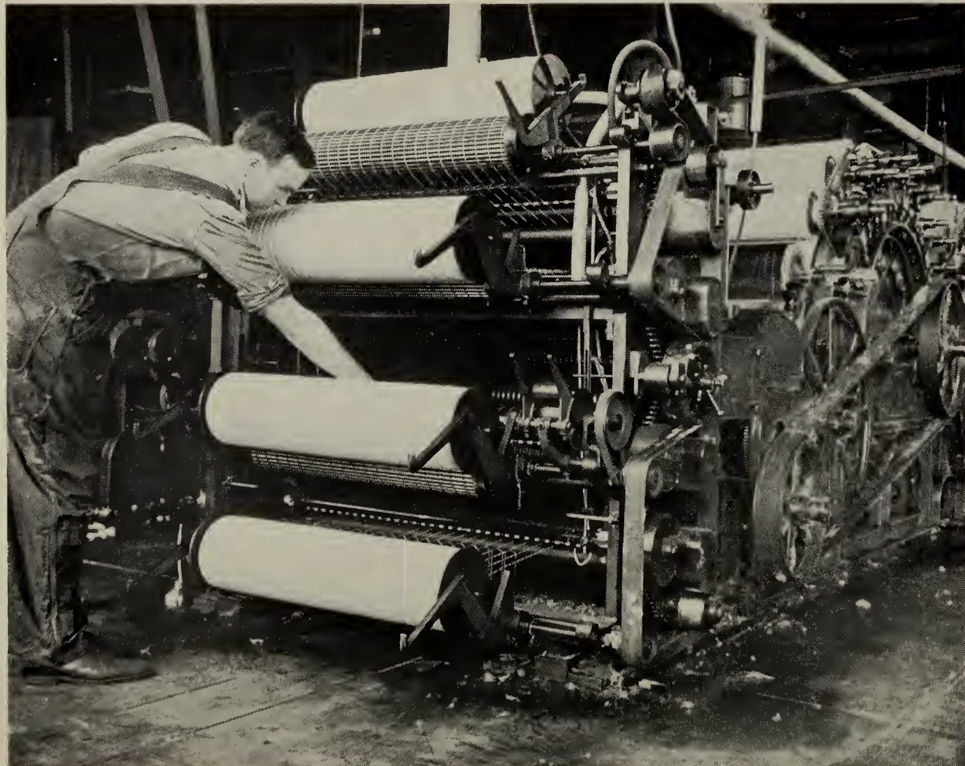
Requirements for Graduation. — In order to receive the degree at the end of the four-year program a student must conform to the following limitations:

1. Maintain a minimum 2.50 cumulative point average.
2. Evidence no failures in the courses taken in the major department.
3. Complete the prescribed curricula with no substitutions for courses in the major department.
4. Offer acceptable equivalent substitutions for any permanent failures. In this regard, substitute courses, taken either at Lowell Textile Institute or any recognized collegiate institution, must be in an identical area of learning to the course(s) failed.

Withdrawal. — The continuance of any student on the rolls of Lowell Textile Institute, the issuance of grades, the conferring of degrees, and the continuance of any of the traditional relationships between the student and the Institute shall be strictly subject to the discretionary powers of the Institute. Lowell Textile Institute expressly reserves the right and the student expressly concedes the right, to require withdrawal of any student at any time and for any reason deemed sufficient to it.



SUPERDRAFT ROVING FRAME



WOOLEN CARD

STUDENT LIFE

Extra-curricular activities are vigorously encouraged. With organization of the first general Student Government in the winter of 1948 and with the completion of the first dormitories in the history of the Institute, extra-curricular activities are expected to expand widely in both athletic and non-athletic areas. At the time of publication of this Bulletin, the following student activities are functioning or are in process of organization.

Athletics. — All students, by virtue of payment of the student athletic tax, are members of the Athletic Association and are represented by an executive council of sixteen, consisting of the president and athletic representative from each of the four classes, the captains and managers of the three varsity sports, and one representative each from the Pickout and the Textile Players. This Council acts as an advisory body to the Athletic Director, has charge of social and athletic events run by the Athletic Association, and ratifies the awarding of letters and appointment of student managers in the various sports.

The schedules of all sports are arranged with the interest of both the Institute and the individual members of the teams in mind. Admission to all home contests is included in the athletic fee which is paid by each student at the time of registration.

Football, basketball, and baseball teams are supported by the Institute and compete regularly in Intercollegiate competition throughout the Northeast.

Clubs:

1. Student Chapter, American Association of Textile Chemists and Colorists
2. Student Chapter, Textile Section, American Society of Mechanical Engineers (being organized)
3. Camera Club (being organized)
4. Glee Clubs for Men and Women
5. International Club, for foreign students
6. Orchestra (being organized)
7. Rifle Club. The Rifle Club participates in intercollegiate matches
8. Textile Players, the dramatic club

Fraternities and Sororities. — Four fraternities are organized and are located in their own houses close to the campus, namely: Alpha Epsilon, Delta Kappa Phi, Omicron Pi, and Phi Psi. These fraternities are coordinated through the Interfraternity Council.

One sorority, Phlame, is available to the girls.

Honorary Society. — Tau Epsilon Sigma is the scholastic honor society. Only seniors, who have maintained a high scholastic average for their first three years, are eligible.

Publications. — The *Text* is published bi-weekly by the students and the *Pickout* is published as an annual "Yearbook." These publications offer excellent journalistic experiences to interested students.

Student Political Groups — The Student Government of Lowell Textile Institute and its duly elected Council represent the student's means for self-expression. Within limits, the Student Government exercises authority over the formation of new student activity groups and serves to stimulate and encourage an active, intelligent, extra-curricular program.

Each class has its own elected officers to represent its interests in the affairs of the Institute.

PLACEMENT BUREAU

A central placement bureau functions through the Dean's Office. This placement service is aimed primarily at assisting the placement of graduating students in industry and in aiding alumni of the Institute to re-locate in new and happier circumstances. Location of part-time work rests with the student.

COURSES FOR THE BACHELOR OF SCIENCE DEGREE

Lowell Textile Institute offers eight curricula options, all leading toward the B.S. degree. A student chooses the desired option at the conclusion of the first semester of the freshman year and begins to specialize during the second semester of the freshman year. All curricula are sufficiently broad in educational scope during the first two years to permit a student to alter his initial choice of curriculum with a minimum ofl ost time, should a new objective become desirable.

A detailed program of the instruction included in each curricula is given in the form of tabular outlines, showing for each semester all courses required, the number of semester credit hours assigned to each course (a semester credit hour represents one hour of lecture or 2–3 hours of laboratory each week for a minimum term of sixteen weeks), and the total number of contact hours in class each week. A more detailed description of each course offered at Lowell Textile Institute may be found in the section of this Bulletin "COURSE DESCRIPTIONS," wherein the courses are listed alphabetically and may be found by referring to the same course number designations shown in the tables below.

First Year. First Semester (Common to All Courses)

			Credit Hours
Chem.	101	General Inorganic Chemistry	5
Math.	101	Mathematics	4
Engl.	101	English Composition and Literature	3
Phys.	101	Physics	3½
Eng.	111	Engineering Drawing	2
Tex.	101	Survey of Textiles	1
		Physical Education	0
		Credit Hour Total	18½
		Contact Hour Total	28

COURSE I. — COTTON MANUFACTURE

The Cotton Manufacturing curriculum is intended for students contemplating a career in the manufacture of cotton textiles or textiles produced from any staple fiber utilizing the cotton system of fiber manipulation.

Since cotton itself is the most important textile fiber in terms of domestic and world-wide consumption, it is the policy of this course first to give the student a thorough course of instruction in handling cotton. Later, the adaptation of cotton machinery to handle rayon, wool, and other staple fibers is covered. Further, the student is given some orientation to other basic manufacturing systems (wool, filament) in order to develop a well-rounded textile viewpoint.

Around the core of manufacturing subjects there is built an educational background in engineering, science, liberal arts, and business administration aimed at giving the student a broad, versatile basis for assuming his responsibilities in industry and society.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Math.	102	Mathematics	4
Engl.	102	English Composition and Literature	3
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Tex.	102	Introduction to Fibers	2
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	29

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Cotton	201–202	Cotton Carding	5	5
Cotton	211	Cottons	1½	–
Cotton	222	Cotton Waste Processing	–	1½
Des.	101	Textile Design	3	–
Des.	222	Textile Design	–	2
Weav.	211–212	Weaving	2½	2½
Color	262	Color	–	1
Tex.	241	Library	1	–
Eng. 222 or Soc. Sci. 212		Appreciation of Literature or World History	–	3
		Credit Hour Total	21	19
		Contact Hour Total	30	28

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Cotton	301	Spinning	4	–
Cotton	302	Winding and Twisting	–	5
Cotton	311	Staple Fiber Manufacture	1½	–
Cotton	322	Quality Control	–	1
Wool	311–312	Survey of Wool Manufacture	2	2
Des.	223	Textile Design	2	–
Weav.	311–312	Weaving	2½	2½
Tex.	311–312	Textile Testing	3	3
Chem.	221–222	Textile Chemistry	2	2
Eco.	201–202	Economics	3	3
		Credit Hour Total	20	18½
		Contact Hour Total	28	31

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Cotton	401	Mill Organization	4	–
Cotton	402	Management Problems	–	2
Finish.	421–422	Cotton Finishing	3	3
Knit.	401	Knitting	4	–
Eco.	351	Textile Marketing	2	–
Eco.	412	Business Administration	–	4
Eng.	202	Speech	–	2
Eng.	212	Business English	–	1
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Syn.	322	Filament Processing Survey	–	2
Elective			3–4	2–3
		Credit Hour Total	19–20	19–20
		Contact Hour Total	22–30	21–30

COURSE II — WOOL MANUFACTURE

The option in Wool Manufacturing is arranged for students who contemplate a career in those industries utilizing the wool fiber or using the woolen and/or worsted system of machinery to process staple fibers of any type.

As with the Cotton Manufacturing program, the student is oriented to all fibers and all basic processing systems, but in this case primary emphasis is given to the wool fiber. The educational philosophy behind Course II is identical to that described for Course I, and every effort is made to give the student a versatile educational background without losing sight of his vocational goal.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Math.	102	Mathematics	4
Engl.	102	English Composition and Literature	3
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Tex.	102	Introduction to Fibers	2
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	29

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Wool	201–202	Fiber Preparation	2	2
Wool	211–212	Top Making	4	4
Des.	101	Textile Design	3	–
Des.	232	Textile Design	–	2
Weav.	211–212	Weaving	2½	2½
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Tex.	241	Library	1	–
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	–	3
Eng.	212	Heat and Power	–	3
		Credit Hour Total	20½	20½
		Contact Hour Total	30	30

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Wool	301–302	Woolen Yarns	2	3
Wool	321–322	Worsted Yarns	4	5
Weav.	311–312	Weaving	2½	2½
Eco.	351	Textile Marketing	2	–
Des.	233	Design	2	–
Chem.	221–222	Textile Chemistry	2	2
Cotton	331–332	Survey of Cotton Manufacturing	2	2
Eco.	201–202	Economics	3	3
Des.	262	Color	–	1
Tex.	302	Properties and Application of Fabrics	–	2
		Credit Hour Total	19½	20½
		Contact Hour Total	29	29

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Tex.	311–312	Textile Testing	3	3
Eng.	422	Textile Instrumentation	–	2
Syn.	322	Filament Processing Survey	–	2
Knit.	401	Knitting	4	–
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Fin.	401–402	Wool and Worsted Finishing	3	3
Eco.	341	Textile Costing	3	–
Eco.	412	Business Administration	–	4
Wool	412	Woolen Mill Organization	2	–
Wool	422	Worsted Mill Organization	2	–
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	20	20
		Contact Hour Total	27	23

COURSE III — TEXTILE DESIGN

This course of four years leading to a degree of Bachelor of Science is especially intended to equip students for a career in the field of textile designing and styling. Full opportunity is given for the development of creative ideas with an extensive background of essential scientific and practical manufacturing training, integrated to a basic core of courses in the liberal arts, economics, and business administration.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	104	Mechanism	2
Engl.	102	English Composition and Literature	3
Math.	102	Mathematics	4
Tex.	102	Introduction to Fibers	2
Des.	102	Elementary Textile Design	3
Des.	112	Handloom Weaving	1
Des.	122	Perspective	1
Des.	132	Freehand Drawing	1
		Physical Education	0
		Credit Hour Total	21
		Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Des.	203–204	Textile Design — Cotton and Synthetics	2½	2½
Des.	211–212	Textile Design — Wool and Worsted	2½	2½
Des.	242	Decorative Design	–	1
Des.	251–252	Color	2	2
Weav.	201–202	Weaving	3	3
Tex.	241	Library	1	–
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Chem.	221–222	Textile Chemistry	2	2
Engl.	222	Appreciation of Literature		
		or	–	3
Soc. Sci.	212	World History		
		Credit Hour Total	21	20
		Contact Hour Total	29	30

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Des.	301–302	Textile Design — Cotton and Synthetics	2½	2½
Des.	311–312	Textile Design — Wool and Worsted	2½	2½
Weav.	301–302	Weaving	3	3
Cotton	331–332	Survey of Cotton Manufacture	2	2
Wool	311–312	Survey of Wool Manufacture	2	2
Syn.	322	Survey of Filament Processing	–	2
Eco.	351	Textile Marketing	2	–
Tex.	302	Application and Properties of Fabrics	–	2
Eco.	201–202	Economics	3	3
Eco.	341	Textile Costing	3	–
		Credit Hour Total	20	19
		Contact Hour Total	28	27

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Des.	401	Textile Design — Wool and Worsted	2	–
Des.	402	Textile Design — Cotton and Synthetics	–	2
Des.	411–412	Jacquard Design and Weaving	2	2
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
Knit.	403	Knitting	3	–
Eco.	412	Business Administration	–	4
Fin.	412	Wool and Worsted Finishing	–	4
Fin.	431	Cotton and Rayon Finishing	4	–
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Tex.	311–312	Textile Testing	3	3
Elective			3	–
		Credit Hour Total	20	21
		Contact Hour Total	22–30	25

COURSE IV — CHEMISTRY AND TEXTILE COLORING

This curriculum is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

Therefore, the student is given a broad background in basic chemistry, coordinated with an understanding of textile fibers and their manipulation into yarn and fabric and subsequent physical and chemical modification. Taken together with a core of liberal arts and economic subjects, this program provides a diversified training to match the inherent complexity of the textile chemistry field and the society of which it is a part. Furthermore, since many majors in textile chemistry plan graduate study, the curriculum is in part designed to give such students adequate background for this advanced study.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Chem.	122	Qualitative Analysis	4
Chem.	124	Stoichiometry	1
Math.	102	Mathematics	4
Tex.	102	Introduction to Fibers	2
Engl.	102	English Composition and Literature	3
Eng.	103	Mechanism	2
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	31

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Chem.	201–202	Organic Chemistry	3	3
Chem.	211–212	Quantitative Analysis	4	4
Chem.	231	Library	1	–
Phys.	201–202	Physics	4	4
Math.	203	Mathematics	4	–
Math.	204	Mathematics in Chemistry	–	2
Tex.	201–202	Textile Manufacturing	3	3
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	19	19
		Contact Hour Total	28	27

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Chem.	321–322	Textile Chemistry . . .	3	3
Chem.	331–332	Physical Chemistry . . .	3	4
Chem.	341	Textile Quantitative Analysis .	3	–
Eco.	201–202	Economics	3	3
Des.	101	Textile Design and Cloth Construction	3	–
Tex.	302	Application and Properties of Fabric	–	2
Tex.	311–312	Textile Testing	3	3
Restricted Electives*				
Chem.	352	Chemical Engineering		
or		or . . .	–	2–3
Ger.	302	Scientific German		
Eng.	351	Statistics		
or		or	3	–
Ger.	301	Scientific German		
Chem.	312	Textile Quantitative Analysis		
or		or . . .	–	3
Chem.	342	Organic Qualitative		
		Credit Hour Total . .	21	20–21
		Contact Hour Total . .	29	29–30

* If German is elected during the first semester, it must be continued throughout the year.

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Chem.	411–412	Textile Chemistry and Dyeing .	4	4
Chem.	421	Advanced Chemical Testing .	3	–
Chem.	431	Colloid Chemistry . . .	3	–
Soc. Sci.	301	Industry and Society . . .	3	–
Soc. Sci.	302	Modern Labor Problems . .	–	3
Eco.	351	Textile Marketing . . .	2	–
Fin.	431	Cotton and Rayon Finishing .	4	–
Fin.	412	Wool and Worsted Finishing .	–	4
Restricted Electives				
Chem.	313	Textile Quantitative Analysis	3	
Chem.	441	Advanced Chemical Engineering		
Chem.	451	Natural High Polymers		
Chem.	461	Microbiology		
Chem.	471	Advanced General Chemistry		
Chem.	483	Textile Chemistry Seminar		
Chem.	491	Advanced Chemical Microscopy		
Eco.	412	Business Administration		4
or		or		
Eco.	344	Principles of Selling and Advertising		
Chem.	432	Applied Colloid Chemistry		3
Chem.	452	Synthetic High Polymers		
Chem.	462	Microbiology		
Chem.	474	Advanced Dyeing		
Chem.	484	Textile Chemistry Seminar		
Free Electives		. . . .	–	3
		Credit Hour Total . .	22	21
		Contact Hour Total . .	Maximum of 30	

COURSE V — SYNTHETIC TEXTILES

This curriculum is designed for those students interested in any segment of the textile industry primarily devoted to the utilization of synthetic fibers, with particular emphasis on continuous filament textiles.

The synthetic fiber phase of textiles is the most recent addition to the field and may be said to be the only section of the industry created wholly in the chemical research laboratories of the country. As such, an understanding of the utility of synthetic fibers depends upon a sound training in chemistry, physics, and mathematics and a thorough awareness of the chemical and physical properties of synthetics which limit their use, in pure form or in blends. Courst V, therefore, will be found to be a compromise between the manufacturing courses (I, II) and the chemistry course (IV) and it is hoped that majors in this program will be equally acceptable to the textile manufacturer, the synthetic fiber producer, or the graduate schools of the country.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Math.	102	Mathematics	4
Eng.	102	Mechanism	4
Tex.	102	Introduction to Fibers	2
Engl.	102	English Composition and Literature	3
Syn.	102	Seminar	1
		Physical Education	0
		Credit Hour Total	18
		Contact Hour Total	22

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Chem.	201–202	Organic Chemistry	3	3
Tex.	201–202	Textile Manufacturing	3	3
Des.	102	Textile Design	–	3
Eco.	201–202	Economics	3	3
Tex.	241	Library	1	–
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	18	19
		Contact Hour Total	24	25

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Syn.	301–302	Filament Yarn Processing	2	2
Syn.	311–312	Synthetic Fibers	3	3
Weav.	211–212	Weaving	2½	2½
Tex.	311–312	Textile Testing	3	3
Tex.	302	Application and Properties of Fabrics	–	2
Chem.	221–222	Textile Chemistry	2	2
Eco.	351	Textile Marketing	2	–
Des.	222–223	Textile Design	2	2
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	–	3
Soc. Sci.	221	Industrial History	3	–
		Credit Hour Total	19½	19½
		Contact Hour Total	25	27

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Syn.	401–402	Filament Yarn Processing	2	2
Syn.	411–412	Synthetic Fibers	3	3
Syn.	452	Synthetic Fiber Seminar	–	2
Eng.	351	Statistics	3	–
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Weav.	311–312	Weaving	2½	2½
Knit.	401	Knitting	4	–
Eco.	412	Business Administration	–	4
Free Electives			2	3
		Credit Hour Total	19½	19½
		Contact Hour Total	28–30	23–30

COURSE VI — TEXTILE ENGINEERING

Two options are offered in Textile Engineering, *viz.*, General Manufacturing and Engineering. It is the basic belief of the faculty and administration at Lowell Textile Institute that except in certain highly specialized areas, *e.g.*, chemistry, the ideal training for the textile industry and for efficient, intelligent citizenship combines an understanding of textile processing relating to all fibers, a sound engineering and scientific background, and an orientation to society and business through a selected core of liberal arts and economic courses. Although the credit hour ratings assigned to VI-G and VI-E are somewhat above the average, experience has shown that they are within the capacity of the student of serious intent who really desires the broad training they provide.

GENERAL MANUFACTURING OPTION — VI-G

The General Manufacturing Option is designed for the man who wishes a thorough preparation in the manufacturing and processing of all textile fibers This practical textile training is combined with a background in basic engineering subjects to fit the student to meet the demand of the textile and allied industries for men with a combined textile and technical preparation.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Engl.	102	English Composition and Literature	3
Tex.	102	Introduction to Fibers	2
Math.	102	Mathematics	4
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	27

		Second Year	Credit Hours First Semester	Credit Hours Second Semester
Math.	201–202	Mathematics	3	3
Phys.	201–202	Physics	4	4
Chem.	221–222	Textile Chemistry	2	2
Des.	101	Textile Design	3	–
Des.	224	Textile Design — Cotton and Synthetics	–	2
Des.	234	Textile Design — Wool and Worsted	–	2
Weav.	221–222	Weaving	2	2
Cot.	203–204	Cotton Carding	4	4
Wool Wool	201–202 211–212	Fiber Preparation Top Making	4	4
		Credit Hour Total	22	23
		Contact Hour Total	26	30

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Eco.	201–202	Economics	3	3
Tex.	311–312	Textile Testing	3	3
Phys.	321	Electronics	3½	–
Eng.	321	Strength of Materials	3	–
Eng.	344	Electrical Machinery	–	4
Cot.	303	Cotton Spinning	3	–
Cot.	304	Cotton Winding and Twisting	–	3
Wool / Wool	301–302 / 321–322	Woolen Yarns / Worsted Yarns	5	6
Weav.	321–322	Weaving	2	2
Tex.	241	Library	1	–
		Credit Hour Total	23½	21
		Contact Hour Total	29	26

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Fin.	431	Cotton and Rayon Finishing	4	–
Fin.	412	Wool and Worsted Finishing	–	4
Eng.	311	Heat Engineering	4	–
Eng.	402	Textile Applications of Electricity	–	1
Eng.	422	Textile Instrumentation	–	2
Cot.	401	Mill Organization	4	–
Knit.	404	Knitting	–	3
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Syn.	322	Filament Processing Survey	–	2
Tex.	302	Properties and Applications of Fabrics	–	2
Eco.	341	Textile Costing	3	–
Eco.	351	Textile Marketing	2	–
Eco.	412	Business Administration	–	4
Eng. or Phys.	431 or 401	Advanced Physical Testing or Advanced Textile Microscopy	2–3	–
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	22–23	24
		Contact Hour Total	27–30	30

ENGINEERING OPTION — VI-E

This option is designed to give the student a thorough preparation in the fundamental principles of mechanical engineering with specialization in the engineering problems arising out of textile manufacturing in all its branches. It emphasizes basic engineering rather than the details of textile processing and should equip the student with the necessary background to enter any branch of the textile or allied industries in an engineering capacity.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	232	Machine Tool Laboratory	1
Engl.	102	English Composition and Literature	3
Tex.	102	Introduction to Fibers	2
Math.	102	Mathematics	4
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	27

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Eng.	201	Machine Drawing	1	–
Eng.	221	Textile Mechanism	1½	–
Eng.	222	Applied Mechanics	–	3
Eng.	233	Machine Tool Laboratory	1	–
Math.	201-202	Mathematics	3	3
Phys.	201–202	Physics	4	4
Tex.	201–202	Textile Manufacturing	3	3
Des.	101	Elementary Textile Design	3	–
Des.	224	Textile Design — Cotton and Synthetic	–	2
Des.	234	Textile Design — Wool and Worsted	–	2
Weav.	221–222	Weaving	2	2
Engl.	201	Speech	2	–
Tex.	241	Library	1	–
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	–	3
		Credit Hour Total	21½	22
		Contact Hour Total	30	25

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Eng.	301–302	Advanced Applied Mechanics	3	3
Eng.	312	Heat Engineering	–	4
Eng.	331	Mill Engineering	3	–
Eng.	342	Electrical Machinery	–	4
Eng.	351	Statistics	3	–
Eco.	201–202	Economics	3	3
Engl.	212	Business English	–	1
Tex.	302	Application and Properties of Fabrics	–	2
Tex.	311–312	Textile Testing	3	3
Weav.	321–322	Weaving	2	2
Phys.	321	Electronics	3½	–
		Credit Hour Total	20½	22
		Contact Hour Total	22	25

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Eng.	401	Electrical Engineering	4	–
Eng.	402	Textile Applications of Electricity	–	1
Eng.	411	Advanced Heat Engineering	3	–
Eng.	422	Textile Instrumentation	–	2
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Fin.	412	Wool and Worsted Finishing	–	4
Fin.	431	Cotton and Rayon Finishing	4	–
Knit.	404	Knitting	–	3
Eco.	341	Textile Costing	3	–
Eco.	412	Business Administration	–	4
Tex.	432	Fabric Development	–	2
Eng.	431	Advanced Physical Testing		
or		or	2–3	–
Phys.	401	Advanced Textile Microscopy		
Phys.	402	Advanced Textile Physics		
or		or	–	3
Eng.	424	Machine Design		
		Credit Hour Total	19–20	22
		Contact Hour Total	26–29	29–30

COURSE VII — TEXTILE SALES

This option is designed for those interested in the distribution, marketing, and sales of textile products. An attempt is made to give the student not only training in the fundamental principles of sales, advertising, and the economic factors influencing the market, but also to prepare a broad scientific and manufacturing background, so necessary to an intelligent awareness of the utility of the myriad of textile products.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Engl.	102	English Composition and Literature	3
Tex.	102	Introduction to Fibers	2
Math.	102	Mathematics	4
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	27

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Math.	203	Mathematics	4	–
Tex.	241	Library	1	–
Des.	262	Color	–	1
Phys.	201–202	Physics	4	4
Cot.	331–332	Cotton Manufacturing Survey	2	2
Wool	311–312	Wool Manufacturing Survey	2	2
Syn.	322	Filament Processing Survey	–	2
Des.	101	Textile Design	3	–
Des.	222	Textile Design — Cotton and Synthetics	–	2
Weav.	211–212	Weaving	2½	2½
Chem.	221–222	Textile Chemistry	2	2
Engl. 222 or Soc. Sci. 212		Appreciation of Liberature or World History	–	3
		Credit Hour Total	20½	20½
		Contact Hour Total	26	28

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Eco.	201–202	Economics	3	3
Eco.	311	Statistics	3	–
Eco.	321	Principles of Marketing	3	–
Eco.	322	Marketing Methods	–	4
Eco.	344	Principles of Selling and Advertising	–	4
Tex.	311–312	Textile Testing	3	3
Des.	223	Textile Design — Cotton and Synthetics	2	–
Des.	232	Textile Design — Wool and Worsted	–	2
Weav.	311–312	Weaving	2½	2½
Engl.	201	Speech	2	–
Engl.	212	Business English	–	1
		Credit Hour Total	18½	19½
		Contact Hour Total	22	23

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Eco.	341	Textile Costing	3	–
Eco.	412	Business Administration	–	4
Eco.	421	Foreign Trade	3	–
Eco.	431–432	Selling Policies	3	3
Fin.	412	Wool and Worsted Finishing	–	4
Fin.	431	Cotton and Rayon Finishing	4	–
Tex.	302	Properties and Application of Fabrics	–	2
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Des.	233	Textile Design — Wool and Worsted	2	–
Des.	414	Jacquard Design	–	1
Electives			2–3	2–3
		Credit Hour Total	20–21	19–20
		Contact Hour Total	23–30	22–30

COURSE DESCRIPTIONS

1. First semester courses are indicated by odd numbers.
2. Second semester courses are indicated by even numbers.
3. Courses conducted for a full year are indicated by double numbers, and the credit hours shown are for the entire year.
4. Each course is listed with the number of lecture and laboratory hours, and the number of credit hours carried by the course. Prerequisite subjects, if required, are noted with each description.
5. Admission to any course without the prerequisite requirements must be obtained from the Head of the Department concerned.

   Courses numbered 100–199 are normally given at the freshman level.

   Courses numbered 200–299 are normally given in the second year.

   Courses numbered 300–399 are normally given in the third year.

   Courses numbered 400–499 are normally given in the fourth year.

   Courses numbered 500 and above are restricted to graduate students.

Courses Are Listed Alphabetically by Subject Classification, Irrespective of the Department Involved.

CHEMISTRY

Chem. 101–102 GENERAL INORGANIC CHEMISTRY 9 Credit Hours

Three lectures and one recitation period per week, first semester

Two lectures and one recitation period per week, second semester

One three-hour laboratory period per week, both semesters

The first semester is concerned with the basic principles of chemistry and a consideration of non-metallic elements and their compounds. In the second semester, attention is focussed on metals and their compounds, and the basis is laid for qualitative analysis.

Chem. 114 ELEMENTARY ORGANIC CHEMISTRY 3 Credit Hours

Three lectures per week

Prerequisite: Chem. 101

This course is designed for those not planning to continue in chemistry and broadly covers the basic principles of organic chemistry.

Chem. 122 QUALITATIVE ANALYSIS 4 Credit Hours

One lecture and one recitation period per week

Two four-hour laboratory periods per week

Prerequisite: Chem. 101

The course covers the systematic qualitative analysis of inorganic compounds. Some emphasis is placed on textile applications in the design of laboratory experiments.

Chem. 124 STOICHIOMETRY 2 Credit Hours

Two hours per week

Prerequisites: Chem. 101, Math. 101

The elementary calculations of inorganic chemistry and quantitative analyses.

CHEM. 201–202 GENERAL ORGANIC CHEMISTRY 6 CREDIT HOURS
Two lectures per week
One four-hour laboratory period per week
Prerequisite: CHEM. 102

A study of the important classes of carbon compounds and the fundamental theories of organic chemistry.

CHEM. 211–212 QUANTITATIVE ANALYSIS 8 CREDIT HOURS
One lecture and one recitation period per week
Two three-hour laboratory periods per week
Prerequisite: CHEM. 122

This course covers the fundamental principles of quantitative analysis. The first semester emphasizes gravimetric methods of analysis. Volumetric techniques are covered during the second semester.

CHEM. 221 TEXTILE CHEMISTRY 2 CREDIT HOURS
Two lectures per week
Prerequisite: CHEM. 102

This course is designed for those not planning to continue in chemistry and consists of a series of lectures covering the various processes preliminary to dyeing, dyeing methods, and basic information on dyes and other textile chemicals of significance to these processes.

CHEM. 222 TEXTILE CHEMISTRY 2 CREDIT HOURS
One lecture per week
One three-hour laboratory per week
Prerequisite: CHEM. 221

Second semester continuation of CHEM. 221, but not required of all students taking CHEM. 221.

CHEM. 231 LIBRARY 1 CREDIT HOUR
Two hours per week

The object of this course is to introduce the student to classical and modern sources of information on chemical and textile subjects and to familiarize the students with the proper use of a library.

CHEM. 312 TEXTILE QUANTITATIVE ANALYSIS
One lecture per week 3 CREDIT HOURS
Two three-hour laboratory periods per week
Prerequisite: CHEM. 212

This course applies to basic principles of chemical analysis covered in CHEM. 122 and 211–212 to the examination of materials used in the textile mill, the dye house, and the finishing plant. Among the materials covered are water, oils, soaps, fuels, stripping agents, detergents, resins, etc.

CHEM. 313 TEXTILE QUANTITATIVE ANALYSIS
One lecture per week 3 CREDIT HOURS
Two three-hour laboratory periods per week
Prerequisite: CHEM. 312

A continuation of CHEM. 312 but not required of those taking the first semester course.

Chem. 321–322 TEXTILE CHEMISTRY 6 Credit Hours

Two lectures per week
One three-hour laboratory per week
Prerequisites: Chem. 202
Phys. 102 and Eng. 103

This course is designed primarily for those majoring in chemistry and is the first of four semesters relating to the chemistry of dyeing and finishing of all types of textile fibers, *i.e.*, cotton, wool, rayon, nylon, flax, etc. Among the major topics covered the first year are: (1) Operations preliminary to dyeing, (2) Water in the textile industry, (3) Theory of dyeing, (4) Coloring matters, *i.e.*, natural and synthetic organic coloring matters, mineral coloring matter, (5) Dyeing processes.

Chem. 331 PHYSICAL CHEMISTRY 3 Credit Hours

Three lectures per week
Prerequisites: Chem. 102, Math. 203 or Math. 204, Phys. 202

First of two semesters of a study of the important principles of physical chemistry, *i.e.*, gas, liquid, solid state; elementary chemical thermodynamics; determination of molecular weights; viscosity; surface tension; etc.

Chem. 332 PHYSICAL CHEMISTRY 4 Credit Hours

Two lectures and one recitation per week
One three-hour laboratory period per week
Prerequisite: Chem. 331

Second semester continuation of Chem. 331.

Chem. 342 ORGANIC QUALITATIVE ANALYSIS 3 Credit Hours

One lecture per week
Two three-hour laboratory periods per week
Prerequisites: Chem. 122, 202

The purpose of this course is to acquaint the student with the methods of the qualitative determination of unknown organic compounds.

Chem. 352 CHEMICAL ENGINEERING 2 Credit Hours

Two lectures per week
Prerequisites: Chem. 102, Math. 203 or 204, Phys. 202

Descriptive and quantitative information on unit conversion, dimensional analysis, materials of construction, flow of fluids, flow of heat, hygrometry, humidification, dehumidification, and drying with special emphasis on textile applications and textile chemical machinery.

Chem. 411–412 ADVANCED TEXTILE CHEMISTRY AND DYEING 10 Credit Hours

Two lectures per week
Three three-hour laboratory periods per week
Prerequisite: Chem. 322

Continuation of Chem. 321–322, covering a review of the first year's work and, in addition: (1) Color matching and color combining, (2) Dye testing and evaluation, (3) Union dyeing, (4) Printing, (5) Chemistry of textile finishing, (6) Dye house and finishing plant management.

Chem. 414 SPECIAL STUDIES IN DYEING 3 Credit Hours

One lecture per week

Two three-hour laboratory periods per week

A course designed for those desiring more than the required work in dye application. Further work in dye application is taken up, also dye testing, color matching and textile printing.

If the student has a particular problem in the application of dyes, time will be allotted for its study.

Chem. 421 ADVANCED CHEMICAL TEXTILE TESTING

Two lectures per week 3 Credit Hours

One three-hour laboratory period per week

Prerequisite: Tex. 311–312

A series of lectures and laboratory periods designed to supplement the textile testing given in Tex. 311–312. The quantitative as well as the qualitative aspects of the determination of extraneous matter, textile finishing agents, fiber content, and fiber damage is followed by some dyestuff identification and evaluation for fastness. The use of optical equipment such as the colorimeter, tintometer, pH apparatus, spectroscope, spectrophotometer, ultra violet radiation and infrared radiation is also taken up.

Chem. 431 COLLOID CHEMISTRY 3 Credit Hours

Three lectures per week

Prerequisite: Chem. 332

A course covering the basic properties of colloidal materials and the application of these principles to an understanding of the behavior of textile fibers.

Chem. 432 APPLIED COLLOID CHEMISTRY 2 Credit Hours

One lecture per week

One three-hour laboratory period per week

Prerequisite: Chem. 431

A continuation of Chem. 431, but not required of those taking Chem. 431, which further explores the application of the concepts of colloidal chemistry to textile problems.

Chem. 441 ADVANCED CHEMICAL ENGINEERING

Three lectures per week 3 Credit Hours

Prerequisite: Chem. 352

An advanced study of the subjects covered in Chem. 352, and, in addition, further work in thermodynamics, mechanical mixtures, heat engines, etc. This course is an elective continuation of Chem. 352.

Chem. 451 NATURAL HIGH POLYMERS 3 Credit Hours

Three lectures per week

Prerequisites: Phys. 202, Chem. 202, 332, Math. 204

The chemistry and physics of natural cellulosic and protein fibers are presented in relation to (1) occurrence, (2) chemical structure, (3) molecular weight and polymolecularity, (4) orientation and fine structure, (5) physical structure, and (6) the effect of these factors on chemical, physical, and mechanical properties. An attempt is made to correlate the material so that an integrated understanding of the behavior of these polymers in textile materials is developed.

CHEM. 452 SYNTHETIC HIGH POLYMERS 3 CREDIT HOURS

Three lectures per week

Prerequisites: PHYS. 202, CHEM. 202, 332, MATH. 204

The synthetic high polymers of interest in textile applications will be discussed from the following standpoints: (1) Type of polymerization, (2) Theories of polymer formation, (3) Physical and colloid chemistry of high polymers, (4) Molecular weight, molecular weight distribution, methods of estimating molecular weight, (5) Orientation, and (6) Physical and chemical phenomena. A critical approach is made to the evaluation of the usefulness of synthetic high polymers in textile applications.

CHEM. 461 MICROBIOLOGY 2 CREDIT HOURS

One lecture per week

One two-hour laboratory period per week

Prerequisite: CHEM. 202

The course covers the fundamentals of mycological and bacteriological theory briefly but in sufficient detail so that the problem of the microbiological deterioration of textiles may be discussed.

Methods of detecting mildewing, and methods of testing textiles for mildew resistance are considered in the laboratory.

CHEM. 462 MICROBIOLOGY 1 CREDIT HOUR

One three-hour laboratory period per week

Prerequisite: CHEM. 461

The work is arranged according to the interests of the individual student. Laboratory exercises such as the identification of pure cultures, the comparison of commercial mildewproofing agents, etc., are typical.

CHEM. 471 ADVANCED GENERAL CHEMISTRY 2 CREDIT HOURS

Two lectures per week

Prerequisite: CHEM. 332

This course introduces the student to theories which are important in present-day chemistry. In addition, an attempt is made to broaden and deepen the knowledge of the student in his understanding of many phases of ehemistry.

CHEM. 472 INORGANIC PREPARATIONS 3 CREDIT HOURS

Two lectures per week

One three-hour laboratory period per week

Prerequisite: CHEM. 102

The purpose of the course is to familiarize the student with those reactions and processes of inorganic chemistry which are more used in commercial practice than in the laboratory. Experiments are chosen in conference between student and instructor.

CHEM. 474 ADVANCED DYEING 3 CREDIT HOURS

One lecture per week

Two three-hour laboratory periods per week

Prerequisite: CHEM. 411

This elective course is designed for those students with a special area of interest in dyeing and permits individual experimental study with materials selected by the student in conference with the instructor.

CHEM. 481–482 SENIOR THESIS

Hours to be arranged. Topic selected in conference with major professor.

CHEM. 483–484 TEXTILE CHEMISTRY SEMINAR 4 CREDIT HOURS

Two hours per week

Prerequisite: Seniors and Graduate Students in Chemistry only.

A series of informal discussions of current problems in research and technology in the textile chemistry field. Special investigations of the literature will be utilized to serve as a source of seminar topics.

CHEM. 485 or 486 GLASS BLOWING 1 CREDIT HOUR

Three hours of laboratory per week

A practical course designed to give the student an ability to construct and repair apparatus in the chemical or physical laboratory. The standard techniques in soda and pyrex glass are practiced. Included are — straight seals, T seals, inner seals, reduction tubes, capillary tubing, bulbs, flaring, etc., and many combinations of these. Simple metal to glass seals and the ability to handle deKhotinsky cement are also included.

CHEM. 491 APPLICATIONS OF MICROSCOPY 2 CREDIT HOURS

One lecture per week

Three hours of laboratory per week

Prerequisite: TEX. 311–312

Consists principally of laboratory work with occasional lectures on the more advanced aspects of the applications of textile microscopy. Further work on fiber sectioning, fiber casts, and polarized light phenomena is done; also the various quantitative aspects of textile microscopy such as deconvolution count, wool grading, hair identification, and the quantitative analysis of fiber mixtures.

CHEM. 501 or 502 APPLICATIONS OF COLOR MEASUREMENT

Hours to be arranged

Prerequisites: MATH. 203 or 204, PHYS. 202, TEX. 211–212 or equivalent

This course covers the application of various color measuring instruments, with particular emphasis on the interpretation and limitations of the data obtained from each technique. Among the instruments studied are the Tintometer, Colorimeter, and Recording Spectrophotometer.

CHEM. 511 or 512 WETTING AGENTS AND DETERGENTS

Hours to be arranged

Prerequisite: CHEM. 431

A laboratory course, with conferences, on the evaluation of standard wetting agents, detergents, and analogous auxiliaries, with particular emphasis on industrial applications.

CHEM. 521 or 522 TEXTILE TESTING RESEARCH

Hours to be arranged

Prerequisite: CHEM. 421

Special problems relating to the design and evaluation of improved analytical or testing procedures.

CHEM. 523 or 524 GROUP RESEARCH

Hours to be arranged

Limited to 4–6 students

A series of conferences and laboratory periods on the carrying out of a piece of industrial research by the concerted action of a group. The problem is analyzed, its various parts distributed to individuals, and the results combined by the group. The students alternate on supervising the work of the group.

COTTON

Cotton 201–202 COTTON CARDING 10 Credit Hours

Three lectures per week

Two three-hour laboratory periods per week

Prerequisite: Tex. 102

This course relates to the growth, classing, and handling of raw cotton and the processes of opening, picking, carding, combing, drawing, and roving. Considerable time is spent studying cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. The basis of cotton classing is thoroughly covered here and the general background of how cotton is bought and sold is explained. The mill processes are studied in detail, using specially prepared texts and illustrations. Emphasis is placed on the purposes and principles of each machine rather than on skill of operation.

Cotton 203-204 COTTON CARDING 8 Credit Hours

Three lectures per week

One two-hour laboratory period per week

Prerequisite: Tex. 102

This course is similar to Cotton 201–202, but with considerably less laboratory time. The course is aimed at those with a more general interest in textile manufacturing.

Cotton 211 COTTONS 1½ Credit Hours

One hour of lecture per week

One hour of laboratory per week

Prerequisite: Tex. 102

This course consists of lectures and laboratory work, supplementary to Cotton 201–202, for those students who study cotton only. Some time is spent on the details of cotton fiber growth and structure and in comparing cotton with other fibers. The economic importance of cotton is studied and sources of information regarding cotton and its processing are given to the class.

Cotton 222 COTTON WASTE PROCESSING 1½ Credit Hours

One hour of lecture per week

One hour of laboratory per week

Prerequisite: Tex. 102

For those specializing in Cotton Manufacture, this course provides a survey of the methods and machinery used in processing cotton wastes, or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment and the manufacturing processes. Samples of wastes and products are used to demonstrate the possibilities in this field.

Cotton 301 COTTON SPINNING 4 Credit Hours

Two lectures per week

Five hours of laboratory per week

Prerequisite: Cotton 202

This course is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning. Particular consideration is given to the production of yarns for different uses and how desired characteristics may be obtained. All the calculations regarding yarns and spinning frames are thoroughtly studied and problems are assigned for student practice.

Cotton 302 COTTON WINDING AND TWISTING 5 Credit Hours

Two lectures per week

Ten hours of laboratory per week

Prerequisite: Cotton 301

This course is a continuation of the course on spinning, in which the instruction includes the conclusion of spinning, spooling and the various types of winding, twisting of common and fancy yarns and such incidental features as reeling, baling, mule spinning and rope manufacture. (Some of these items are optional.) All the calculations regarding winders and twisters are thoroughly studied and problems are assigned for student practice.

Cotton 303 COTTON SPINNING 3 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisite: Cotton 204

This course is similar to Cotton 301, but the time devoted to laboratory practice is shortened.

Cotton 304 COTTON WINDING AND TWISTING 3 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisite: Cotton 303

This course is similar to Cotton 302, but the time devoted to laboratory practice is shortened.

Cotton 311 STAPLE FIBER MANUFACTURE 1½ Credit Hours

One lecture per week

One hour of laboratory per week

Prerequisite: Cotton 301

Using the preparatory courses as a background, this course offers a study of the methods of manufacture of various staple fibers, such as wool, rayon or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the course is planned to take advantage of the new developments as they appear. Considerable of the work in this course is of the discussion type, which aims to correlate all the work on yarn manufacture and bring it to bear on the processing of staple fibers.

Cotton 322 COTTON QUALITY CONTROL 1 Credit Hour

One lecture per week

Prerequisite: Cotton 301

While it is customary to point out defects in the materials during the processing in all the laboratory work, this course provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this course. Every effort is made to develop the student's diagnostic ability so that he may readily recognize and remedy new defects as he meets them.

Cotton 331–332 COTTON MANUFACTURING SURVEY 4 Credit Hours

Two hours of lecture per week

One hour of laboratory-demonstration per week

For students with but a secondary interest in Cotton Manufacture, this survey course outlines the processes used and the principles in cotton yarn manufacture. The first semester covers cotton qualities and production and the processes through combing. The second semester starts with drawing and completes through spinning, winding and twisting.

While this course is primarily lectures, it is planned to include some laboratory demonstration. Outside preparation will include some study of the standard manufacturing machinery in the laboratory.

Cotton 401 MILL ORGANIZATION 4 Credit Hours

Four lectures per week

Prerequisite: Cotton 302 or 304

This course correlates all of the work on Cotton Manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and the handling of staple fibers are carefully covered. The machinery necessary to keep plants in balance is calculated, with some consideration of the best arrangements for economical handling. Some time is given to the use of efficiency work and end breakage studies for cotton mills.

Cotton 402 MANAGEMENT PROBLEMS 2 Credit Hours

Two lectures per week

Prerequisite: Cotton 302

This course supplements the course in Mill Organization with some added detail regarding the work in Organization. In addition, this course includes work on equipment arrangement for practical routing and operation, auxiliary equipment necessary for manufacturing efficiency, job descriptions and job assignments.

DESIGN

Des. 101 or 102 ELEMENTARY TEXTILE DESIGN 3 Credit Hours

Three lectures per week

One hour of laboratory

Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from the design, and vice versa; extending and extracting weaves. The various topics discussed are relations and determinations of yarn numbers of cotton, woolen, worsted, silk, and yarns made from man-made fibers; grading of yarns, folded, ply, novelty and fancy yarns.

Des. 112 HANDLOOM WEAVING 1 Credit Hour

Three hours of laboratory per week

This work precedes power weaving and consists of making original patterns and cloth construction. This subject correlates with the textile design work and aims to stimulate and inspire the student-designer to realize possible combinations of weave and color in a variety of yarns to produce fabrics for different purposes.

DES. 122 PERSPECTIVE 1 CREDIT HOUR

Two hours of laboratory per week

This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye. This aids the student in freehand drawing.

DES. 132 FREEHAND DRAWING 1 CREDIT HOUR

One two-hour laboratory period per week

This subject consists of freehand practice, by means of progressive steps, in training the eye to see accurately and to develop skill in depicting desired effects. It includes quick sketching and finished drawings of objects and of nature to build a drawing vocabulary which will be an aid to decorative expression.

DES. 203–204 TEXTILE DESIGN AND CLOTH CONSTRUCTION 5 CREDIT HOURS

Two lectures per week

One two-hour laboratory period per week

Prerequisite: DES. 102

In the first term consideration is given to fancy and reverse twills, damasks, skip weaves, and sateen fabrics with plain ground. In the second term fabrics studied are those having extra warp and extra filling figured patterns. Both terms include the analysis of the fabrics as well as the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. *This course is restricted to cotton and synthetic fabrics.*

DES. 211–212 TEXTILE DESIGN AND CLOTH CONSTRUCTION 5 CREDIT HOURS

Two lectures per week

Two hours of laboratory per week

Prerequisite: DES. 102

In the first term instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second term instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas and extra warp and filling figures. *This course is restricted to woolen, worsted, and synthetic fabrics.*

DES. 222–223 TEXTILE DESIGN AND CLOTH CONSTRUCTION 4 CREDIT HOURS

Two lectures per week

One hour laboratory demonstration per week

Prerequisite: DES. 102

This course offers work similar but less detailed to the material covered in DESIGN 203–204 and DESIGN 301–302.

DES. 224 TEXTILE DESIGN AND CLOTH CONSTRUCTION 2 CREDIT HOURS

Two lectures per week

One hour of laboratory per week

Prerequisite: DES. 102

This is a skeleton course patterned after DES. 222–223.

Des. 232–233 TEXTILE DESIGN AND CLOTH CONSTRUCTION
Two lectures per week 4 Credit Hours
One laboratory-demonstration per week
Prerequisite: Des. 102

This course offers work similar but less detailed to the material covered in Des. 211–212 and Des. 311–312.

Des. 234 TEXTILE DESIGN AND CLOTH CONSTRUCTION
Two lectures per week 2 Credit Hours
One laboratory-demonstration per week
Prerequisite: Des. 102

This is a skeleton course patterned after Des. 231–232.

Des. 242 DECORATIVE DESIGN 1 Credit Hour
Two hours of laboratory per week
Prerequisite: Des. 122

Through the principles of decorative design an understanding is acquired for the proper balance, distribution and repetition of motifs suitable for both the woven and the printed pattern. Historic designs of different periods and peoples are covered to supply the student with a background of decorative information. This source of inspiration is coupled with modern thought and application, as an aid to producing appropriate present-day decorative textiles.

Des. 251–252 COLOR — ALL FABRICS 4 Credit Hours
One lecture per week
One hour of laboratory per week

This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks, plaids and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question.

Des. 262 COLOR 1 Credit Hour
One lecture per week
One hour of demonstration per week

This course covers the same general information as Des. 251–252 but in lesser detail.

Des. 301–302 TEXTILE DESIGN AND CLOTH CONSTRUCTION
Two lectures per week 5 Credit Hours
Two hours of laboratory per week
Prerequisite: Des. 203–204

This work takes up the more complicated weaves adapted to harness work, and includes the following fabrics: Extra warp and extra filling checks and clipped spots, together with original layouts as might be required by a mill to produce a new pattern; Bedford Cords, Piques, Velveteens, Corduroys, Collar fabrics, multiply fabrics and narrow webbing. The work in cloth construction includes the application of the different weaves and their combinations in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value. Instruction in this subject is intended to bring together the principles considered under the subject of design, cloth construction, weaving, and yarn making of previous years and to show the bearing each has in the successful construction of a fabric. *This course is restricted to cotton and synthetic fabrics.*

Des. 311–312 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 4 Credit Hours

One hour of laboratory per week

Prerequisite: Des. 211–212

This includes cost estimating for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs; the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, counts of yarn and value. Particular attention is given the construction of new designs by the use of suggestion sheets; the new fabrics to be constructed upon a base fabric, previously analyzed, along the lines outlined on the suggestion sheets, and to keep within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. *This course is restricted to wool, worsted and synthetic fabrics.*

Des. 331 TEXTILE DESIGN AND CLOTH CONSTRUCTION

One lecture per week 2 Credit Hours

One hour of laboratory per week

Prerequisite: Des. 102

Consideration is given to the analysis and comparison of various synthetic fabrics, as to the construction, denier of the yarn, filament count, weave and finish. Some time is also spent in analysis of spun rayon and allied cloths.

Des. 401 TEXTILE DESIGN AND CLOTH CONSTRUCTION

One lecture per week 2 Credit Hours

One one-hour laboratory-demonstration per week

Prerequisite: Des. 311–312

This includes analysis and reproduction of ply fabrics and combinations of work as outlined on suggestion sheets in Des. 311–312. Principles of construction of Chenilles, Wiltons, Brussels, and Axminster rugs and carpeting are also explained. *This course is restricted to wool, worsted, and synthetic fabrics.*

Des. 402 TEXTILE DESIGN AND CLOTH CONSTRUCTION

One lecture per week 2 Credit Hours

One hour of laboratory per week

Prerequisite: Des. 301–302

In this course consideration is given to the more complicated fabrics including elastic fabrics, both narrow and wide woven, Marseilles Quilting, and Toilet Cloths. A working knowledge of the principles involved in the production of Cappet and swivel patterns, and the analysis of such fabrics is explained. A full course in leno design, from plain gauze to the more fancy leno woven patterns, using the modern steel doup and super-doup, is included. *This course is restricted to cotton and synthetic fabrics.*

Des. 411–412 JACQUARD DESIGN AND WEAVING

One lecture per week 4 Credit Hours

One two-hour laboratory period per week

Prerequisites: Des. 102, 242

This subject correlates the instruction in weaving of the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics. The student is taught to transfer his original sketch to cross section design paper, choose the proper weave for both the background and foreground, cut cards and lace, and weave the fabric.

DES. 414 JACQUARD DESIGN 1 CREDIT HOUR

One two-hour laboratory-demonstration per week

Prerequisite: DES. 102

The student is taught to transfer a given motif to cross section paper, choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to appreciate the complete operation from the motif to the loom.

DES. 421 or 422 DESIGN SEMINAR

Hours to be arranged

Prerequisite: Major in Course III or by special permission

This course consists of field trips to selected mills, alternating with reports and seminar discussion of field work.

ECONOMICS

ECO. 201–202 ECONOMICS 6 CREDIT HOURS

Three lectures per week

A basic course in the principles and practices of economics. The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

ECO. 311 ECONOMIC STATISTICS 3 CREDIT HOURS

Three lectures per week

Prerequisite: MATH. 102

This course covers the basic concepts of statistics and emphasizes the particular techniques used in the analysis of business cycles, market analyses, et cetera, of importance to those majoring in sales and distribution of textiles.

ECO. 321 PRINCIPLES OF MARKETING 3 CREDIT HOURS

Three lectures per week

An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed.

ECO. 322 MARKETING METHODS 4 CREDIT HOURS

Four lectures per week

Prerequisite: ECO. 321

A continuation of the Principles of Marketing, Eco. 321. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are, — the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field.

Eco. 341 TEXTILE COSTING 3 Credit Hours

Three lectures per week

Prerequisite: Math. 102

Preparation for this subject also requires the completion of a course in double-entry bookkeeping equivalent to that offered by the University Extension of the Massachusetts Department of Education under the title of Elementary Accounting, Parts 1 and 2. This should be taken during the summer prior to the senior year.

This subject is planned to give a knowledge of modern methods of cost accounting with emphasis upon their application to textile manufacturing processes. It includes discussion of methods of handling and accounting for raw materials, direct labor, overhead and its distribution, normal costs and their predetermination, budgeting, cost reports and their use for control purposes.

Eco. 344 PRINCIPLES OF SELLING AND ADVERTISING 4 Credit Hours

Four lectures per week

A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used.

Eco. 351 TEXTILE MARKETING 2 Credit Hours

Two lectures per week

Prerequisite: Eco. 201–202

This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed.

Eco. 412 BUSINESS ADMINISTRATION 4 Credit Hours

Four lectures per week

Prerequisites: Eco. 201–202, Math. 101–102

The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storekeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. — A brief introduction is given the student on the laws governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy.

Eco. 421 FOREIGN TRADE 3 Credit Hours

Three lectures per week

Prerequisite: Eco. 201–202

The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given to costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business.

Eco. 431–432 SELLING POLICIES 6 Credit Hours

Three lectures per week

Prerequisite: Eco. 322

This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers.

Eco. 501 or 502 ECONOMIC GEOGRAPHY OF TEXTILE RAW MATERIALS

Hours to be arranged

Prerequisite: By permission of instructor

This course concerns itself with the geographic distribution of the sources of natural fibers of plant and animal origin and the sources of the basic chemicals of the synthetic fiber industry, in an effort to understand the world-wide distribution of textile manufacturing, the dependence of the domestic industry on foreign sources of supply, the natural barriers to the expansion of fiber supply in the United States and in other nations, limitations on the expansion of the textile industry in the various competitive areas of the world, and the significance of these raw material supplies to the economy of the United States and to the other nations directly or indirectly involved.

ENGINEERING

ENG. 102 MECHANISM 4 Credit Hours

Three lectures and one recitation per week

Prerequisites: Math. 101, Phys. 101

The principles studied are of general application, textile machinery in particular furnishing an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, epicyclic gear trains, and intermittent motion devices.

Eng. 104 MECHANISM 2 Credit Hours

Two lectures per week

Prerequisite: Math. 101

This course is an abbreviation of Eng. 102 and is designed for those students not majoring in engineering.

Eng. 111–112 ENGINEERING DRAWING 4 Credit Hours

Six hours of laboratory per week

This course is systematically laid out covering in order the following divisions: care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application.

Eng. 122 MACHINE TOOL LABORATORY 1 Credit Hour

Three hours of laboratory per week

Prerequisites: Phys. 101, Eng. 101

A similar but abbreviated course to Eng. 232–233.

Eng. 201 MACHINE DRAWING 1 Credit Hour

Three hours of laboratory per week

Prerequisites: Eng. 101, Eng. 112

This is a continuation of Eng. 111–112 and leads to the making of assembly drawings of textile machines.

Eng. 212 HEAT AND POWER 3 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisite: Phys. 201

An abbreviation of Eng. 312 and Eng. 411, designed for those not majoring in engineering.

Eng. 221 TEXTILE MECHANISM 1½ Credit Hours

One lecture per week

One two-hour laboratory period per week

Prerequisites: Eng. 102–111–112

This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself.

Eng. 222 APPLIED MECHANICS 3 Credit Hours

Three lectures per week

Prerequisites: Math. 201, Phys. 101

This subject covers the fundamentals of statics and kinetics, including such topics as force systems, laws of equilibrium, centers of gravity, moments of inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies.

Eng. 232–233 MACHINE TOOL LABORATORY 2 Credit Hours

One three-hour laboratory period per week

Systematic instruction is given in the most approved methods of machine shop practice to familiarize the student with the proper use of hand and machine tools. Actual work is given in the operations of filing, laying out, straight and taper turning, thread cutting, drilling, boring, planing, shaping, grinding, and milling including gear cutting. Special attention is given to the form, setting, grinding and tempering of tools, and the mechanism of the different machines. Lectures and demonstrations cover such topics as the characteristics of metals, foundry practice, forging, piping, welding, soldering, and die casting.

ENG. 301–302 ADVANCED APPLIED MECHANICS 6 CREDIT HOURS

Three lectures per week

Prerequisites: ENG. 222, MATH 202

This subject covers the general topic of strength of materials; including such topics as simple stresses, strain, bending moments, shearing force, slopes and deflections in beams, beam design, torsion, and design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, and stress analysis by strain gage methods.

ENG. 311 HEAT ENGINEERING 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisites: MATH. 202, PHYS. 202, ENG. 102

This course is a condensation of ENG. 312 and ENG. 411

ENG. 312 HEAT ENGINEERING 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisites: ENG. 101, MATH 202, PHYS. 202

The purpose of this course is to familiarize the student with the principles of elementary thermo-dynamics, the properties of steam, mechanical mixtures and combustion of fuels.

ENG. 321 STRENGTH OF MATERIALS 3 CREDIT HOURS

Three lectures per week

Prerequisites: PHYS. 101, MATH. 203

A more elementary and condensed treatment of ENG. 301–302.

ENG. 331 MILL ENGINEERING 3 CREDIT HOURS

Three lectures per week

Prerequisite: ENG. 222

This course consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construction from a study of actual blueprints; calculation of allowable floor loads; stresses in beams and columns; and machinery layout.

ENG. 332 ENGINEERING MATERIALS 2 CREDIT HOURS

Two lectures per week

Prerequisite: PHYS. 202

This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treatment; also the properties and uses of non-metallic engineering materials such as timber, cement, concrete, rubber, plastics, and mechanical fabrics.

ENG. 342 ELECTRICAL MACHINERY 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisite: PHYS. 321

At the beginning of this subject electronic circuits are considered, but the greater part of the term is devoted to direct current generators and motors with a study of their construction and characteristics. Some time is devoted to electrical measurements.

ENG. 344 ELECTRICAL MACHINERY 4 CREDIT HOURS

Three lectures per week
One two-hour laboratory period per week
Prerequisite: PHYS. 321

This course is a condensation of ENG. 342 and ENG. 401.

ENG. 351 STATISTICS 3 CREDIT HOURS

Three lectures per week
Prerequisite: MATH. 202 or 203

The first part of the course deals with those fundamental statistical measures which are required for the analysis of experimental data and for an understanding of the statistical control of quality. The second part of the course then takes up the practical applications of statistics to textile mill operation.

ENG. 401 ELECTRICAL ENGINEERING 4 CREDIT HOURS

Three lectures per week
One two-hour laboratory period per week
Prerequisite: ENG. 342

This subject includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for this motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor.

ENG. 402 TEXTILE APPLICATIONS OF ELECTRICITY 1 CREDIT HOUR

One field trip per week
Prerequisite: ENG. 344 or 401

This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. The work is covered by trips made to local mills to see the equipment in actual operation.

ENG. 411 ADVANCED HEAT ENGINEERING 3 CREDIT HOURS

Two lectures per week
One two-hour laboratory period per week
Prerequisite: ENG. 312

The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Eng. 422 TEXTILE INSTRUMENTATION 2 Credit Hours

Two lectures per week

Prerequisites: Phys. 321, Eng. 311 or 312

The first half of the course consists of a study of the entire control unit and includes primary measuring elements, controller mechanisms (pneumatic and electric), and final control elements such as valves, motor levers, etc. Proper selection and application are taken up in detail.

During the second half, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, finishing, etc., are studied from data obtained from actual mill installations.

Eng. 424 MACHINE DESIGN 3 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisites: Eng. 221, 233, 302

Dealing first with the design of fundamental machine elements, the work leads to the design of critical parts of some textile machines.

Eng. 431 ADVANCED PHYSICAL TESTING 2 Credit Hours

One lecture per week

One three-hour laboratory period per week

Prerequisite: Tex. 311–312

This course provides a more detailed analysis of the textile testing methods currently utilized in the industry, both in quality control and in research, extending the laboratory work to cover a wider variety of equipment than studied in Tex. 311–312.

ENGLISH AND HUMANITIES

Engl. 101–102 ENGLISH COMPOSITION AND LITERATURE 6 Credit Hours

Three hours per week

A basic course in rhetoric and composition, relating specifically to the four forms of discourse, viz., description, narration, exposition, argumentation. In addition, a selected group of classics is studied and discussed.

Engl. 201 or 202 SPEECH 2 Credit Hours

Two hours per week

The aim of this course is to achieve effective delivery of various types of speech. All kinds of delivery — extemporaneous, impromptu, memorized, etc., are studied and analyzed.

Engl. 211 or 212 BUSINESS ENGLISH 1 Credit Hour

One lecture per week

Analysis and practice in letter-writing, and a study of the basic forms of technical exposition, forming a background for report writing in advanced courses and in industrial activity.

Engl. 222 APPRECIATION OF LITERATURE 3 Credit Hours

Three hours per week

Prerequisite: Engl. 102

This subject is offered for those who wish to study the principles of literary appreciation and criticism.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals — the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical.

Emphasis will also be placed upon the value of an extensive reading program.

FINISHING

Fin. 401–402 WOOLEN AND WORSTED FINISHING

Two lectures per week 6 Credit Hours

One three-hour laboratory period per week

Prerequisites: Wool 302, 312, Des. 233, Chem. 102, Eng. 102

This course is designed to give the student a comprehensive introduction and orientation to the physical rather than chemical aspects of finishing, and includes burling and mending, fulling, washing and speck dyeing, carbonizing, gigging, napping, steaming, singeing, crabbing, brushing, shearing, and pressing.

Fin. 412 WOOLEN AND WORSTED FINISHING

Three lectures per week 4 Credit Hours

One three-hour laboratory period per week

Prerequisites: Wool 302, 312, Des. 233, Chem. 102, Eng. 102

This course is a similar but abbreviated version of Fin. 401–402, designed for students not majoring in wool manufacture.

Fin. 421–422 COTTON AND RAYON FINISHING 6 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisites: Cot. 302, Des. 223, Eng. 102, Chem. 102

This subject is designed to cover the more important physical finishing operations employed in handling cotton and other cellulosic type textiles, and includes cloth room operation, shearing, singeing, washing, water and starch mangles, dryers and stretchers, calenders, quetch and mangles, decating, make-up, yarding, winding, pressing, and papering.

Fin. 431 COTTON AND RAYON FINISHING 4 Credit Hours

Three lectures per week

One three-hour laboratory period per week

Prerequisites: Cot. 302, Des. 223, Eng. 102, Chem. 102

A similar but abbreviated version of Fin. 421–422, designed for students not majoring in cotton manufacture.

KNITTING

Knit. 401 KNITTING 4 Credit Hours

Two lectures per week

Two three-hour laboratory periods per week

Prerequisites: Eng. 102, Des. 102

This course is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

Knit. 403 or 404 KNITTING 3 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisites: Eng. 102, Des. 102

This course is similar to Knit. 401, but has only one-half the laboratory time of Knit. 401.

Knit. 412 ADVANCED KNITTING

Hours to be determined

Prerequisite: Knit. 401

This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems.

LANGUAGES

German 301–302 TECHNICAL GERMAN 6 Credit Hours

Three hours per week

An introductory course in the basic elements of German, leading to a working knowledge of technical German. This course is aimed primarily at developing a reading ability in scientific German.

German 501–502 ADVANCED TECHNICAL GERMAN 6 Credit Hours

Three hours per week

Prerequisite: Ger. 302 or equivalent

German 501 may be taken without continuing German 502

This course is designed to expand the student's elementary understanding of the language, to increase vocabulary, and to develop reading aptitudes in special fields of interest selected by the student.

MATHEMATICS

Math. 101–102 COLLEGE MATHEMATICS 8 Credit Hours

Four hours per week

The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms, graphical and mathematical solution of quadratic and simultaneous equations, and the theory of equations are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term, the following topics are taken up: equations of the straight line, equations of various curves, differentiation of algebraic functions, maximum and minimum values, rates and differentials.

Math. 201–202 MATHEMATICS 6 Credit Hours

Three hours per week

Prerequisite: Math. 101–102

In the first term the following topics are treated: exponential functions, the circle, parabola, ellipse, hyperbola, polar coordinates, indefinite integrals, summation by integration and applications of integration. In the second term the topics treated are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas.

Math. 203 MATHEMATICS 4 Credit Hours

Four hours per week

Prerequisite: Math. 101–102

This subject is a one-term continuation of the work of Math. 101–102. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, trigonometric functions. *This course is designed for those not continuing in engineering.*

Math. 204 MATHEMATICS 2 Credit Hours

Two hours per week

Prerequisite: Math. 203

This subject is for students of chemistry and dyeing who have completed an introduction to analytic geometry and calculus. The following topics are taken up: precision of measurements, use of numbers in calculation, semi-logarithmic and logarithmic graphs, polar coordinates, three component heterogeneous systems, empirical equations, methods of least squares, series, differential equations with chemical applications, and partial derivatives.

PHYSICS

PHYS. 101 PHYSICS 3½ CREDIT HOURS

Two lectures and one recitation per week

One two-hour laboratory period every other week

The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, efficiency of simple machines, hydrostatics, elements of hydraulics, circular and harmonic motions.

PHYS. 201–202 PHYSICS 8 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisites: MATH. 102, PHYS. 101

A basic course relating to the laws and principles of physics and their application. The topics taken up the first term are: wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are: reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis, electronics.

PHYS. 321 ELECTRONICS 3½ CREDIT HOURS

Three lectures per week

One two-hour laboratory period every other week

Prerequisite: PHYS. 201–202

This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. It includes elements of vacuum and gaseous-tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation.

PHYS. 401 ADVANCED MICROSCOPY

Hours to be arranged

Prerequisites: TEX. 311–312, PHYS. 202, MATH. 202 or 203

This course emphasizes a complete physical understanding of the techniques of the microscopist, including the microscope using normal, fluorescent and polarized light, discussions of phase microscopy, staining, etc. Some aspects of microtechnique and photomicrography will be included.

PHYS. 402 ADVANCED TEXTILE PHYSICS 3 CREDIT HOURS

Two lectures per week

One three-hour laboratory period per week

Prerequisites: TEX. 312, PHYS. 202, MATH. 202

Textile Physics is designed primarily for graduate students but may be taken by seniors who have sufficient knowledge of elementary college physics, microscopy and testing. It deals in an analytical and experimental manner with the principles of advanced physics which have important applications to textile technology. The

topics taken up include heat transmission of textile materials, color measurement, calculation of tristimulus values, transformation to dominant wave-length, colorimetric purity and brightness, measurement of refractive index of fibers, applications of phase microscopy, fluorescent microscopy, use of X-ray diffraction methods to determine crystal orientation and structure of fibers, spectrographic analysis, investigation of mineral elements in textile fibers, accurate methods of measuring stress, strain, viscosity, etc. There will be lectures, laboratory work, and assigned reading.

PHYS. 501 or 502 THE PHYSICS OF COLOR MEASUREMENT

Two lectures per week 3 CREDIT HOURS

One three-hour laboratory period per week

Prerequisites: PHYS. 202, MATH. 202 or 203

Color measurement is an elective subject for graduate students who desire a comprehensive knowledge of the philosophy and practice of modern colorimetry. The topics covered include colorimeters, their uses and limitations, spectrophotometers, tristimulus values, dominant wave-length and purity, the "standard observer" concept, the Munsell system, the Ostwald system, color tolerances, gloss and body color, illuminants, and industrial applications.

Laboratory instruments available consist of brightness testers, monochromatic and trichromatic colorimeters, recording and visual spectrophotometers.

SOCIAL SCIENCE

SOC. SCI. 212 WORLD HISTORY SINCE 1900 3 CREDIT HOURS

Three lectures per week

A study of the backgrounds in political, economic, and social conditions in the years preceding the outbreak of World War I, an examination of the world situation during the war years, 1914 to 1918, and a thorough review of the issues at Versailles and the spirit and content of the several treaties and settlements effected at the peace table. The body of the course content will concern the two-decade intermission, 1919–1939, with attention to such factors as the rise of new states, the origin and development of new concepts of nationalism, racism, and other phenomena, and the final alignment of world powers for World War II. The emphasis in the latter part of the course will be upon the role of the United States in mid-twentieth century reconstruction and rehabilitation through world-wide international cooperation in agencies like the United Nations Organization, the International Bank, and others in which the United States must play a leading part.

SOC. SCI. 221 INDUSTRIAL HISTORY 3 CREDIT HOURS

Three lectures per week

A survey of European backgrounds of American industrial development and a study of such factors as immigration, agriculture, domestic and foreign trade, the tariff, transportation, finance capitalism, and the labor movement. The latter half of the year will be devoted largely to consideration of the evolution of mass production organizations and techniques, the rise of national labor organizations, labor legislation, and other significant phenomena of the period since the Civil War. Particular attention will be paid to the economic implications of the two World Wars and to their influences upon the development of modern machine technology.

Soc. Sci. 301 INDUSTRY AND SOCIETY 3 Credit Hours

Three lectures per week

A study of American industrial history since 1870. This course provides the background of modern labor problems, and is intended to develop an appreciation of the many complex factors which make current management-labor relations a matter of major concern in society today.

Soc. Sci. 302 MODERN LABOR PROBLEMS 3 Credit Hours

Three lectures per week

Prerequisite: Soc. Sci. 301

The course will involve the use of a manual of current labor laws which apply in Labor-Management relationships in the United States. Case material will be studied to familiarize the students with Federal and State court actions, rulings of the National Labor Relations Board, and the functions of both public and private conciliators and arbitrators. At intervals during the course the class will meet informally with representatives of both Labor and Management, and opportunities will be provided for discussion of important points with the visiting speakers. The chief objectives of the course will be (1) a proper consideration of the important current issues in collective bargaining and (2) the development of familiarity with the techniques of the bargaining table and the problems in drafting, interpreting, and administering the modern labor contract.

Soc. Sci. 401 INDUSTRIAL RELATIONS SEMINAR

Two hours per week 2 Credit Hours

Prerequisite: Soc. Sci. 302

This course will give a small selected group opportunities to meet with the instructor and occasional visitors in discussion of current problems in industrial relations. Case material and hypothetical problems in modern labor management will provide the basis for the group's study.

SYNTHETIC TEXTILES

Syn. 102 SEMINAR 1 Credit Hour

One hour per week

This seminar for freshmen who have just elected to major in synthetic textiles has for its purpose the general integration, in the mind of the student, of the various courses in his curricula in terms of his educational objective. Since the student does not begin intensive study in synthetic textiles until his junior year, it is of vital importance that he be fully aware and fully understanding of the significance of the basic educational program of the first two years.

Syn. 301–302 FILAMENT YARN PROCESSING 4 Credit Hours

One lecture per week

One three-hour laboratory period per week

Prerequisite: Tex. 201–202

This course deals with the processing of man-made continuous filament fibers from the time they are made available to the textile industry by the manufacturers until they are ready for processing into fabric. The purposes, means of accomplishment, and results obtained in the various operations of pretreatment, throwing, twist setting, coning, inspection, and quality control are covered in the lectures and supplemented by demonstrations and laboratory work. During the second term, symposia based on literature surveys will be conducted by the students, and the subject of plant layouts is introduced. Field trips to local plants are an integrated part of the course.

Syn. 311–312 SYNTHETIC FIBERS 6 Credit Hours

Three lectures per week

Prerequisite: Tex. 201–202

This course deals with the manufacture and properties of man-made fibers. The rayons, polyamides (nylons), vinyl, protein, mineral, and metallic fibers are considered from the standpoint of their manufacture and economic aspects, and their fundamental structure and properties. An attempt is made to correlate the material so that a critical evaluation of the fibers can be made. Part of the course is conducted in the manner of a symposium, with the students reporting on current research and work on man-made fibers, as reported in the contemporary literature.

Syn. 322 SURVEY OF FILAMENT PROCESSING

Two lectures per week 2 Credit Hours

Prerequisite: Tex. 102

A survey of the methods of handling synthetic fibers in filament form designed to give the student a broad picture of the differences and their significances between staple and filament yarn production. Some of the lecture time will be devoted to laboratory demonstration and outside assignments may be made involving special use of the laboratory equipment.

Syn. 401–402 FILAMENT YARN PROCESSING 4 Credit Hours

One lecture per week

One three-hour laboratory period per week

Prerequisite: Syn. 301–302

This course is a continuation of Syn. 301–302. The manipulation of filament yarns in throwing to obtain desired characteristics in fabrics are discussed. Plant layouts are discussed from the viewpoints of productive ability, the economics of various machine arrangements, operator loads, and over-all plant operation on a competitive basis. During the second term, the economic position of the filament yarn processing industry in the textile and the national economy as a whole is covered, with the latter part of the term devoted to a seminar on the subject. Symposia conducted by the students on selected subjects will be a part of the regular class work. Laboratory work, in general, will be confined to the handling of special problems.

Syn. 411–412 SYNTHETIC FIBERS 6 Credit Hours

Three lectures per week

Prerequisite: Syn. 311–312

This course is a continuation of Syn. 311–312. It is conducted as much as possible as a seminar with numerous symposia. Much of the time will be spent on considerations of the fundamental properties and structures of man-made fibers in relation to each other and to the properties of the finished textile. To make the material more useful, natural fibers and their textiles are also included. Recent advances in the manufacture of fibers will be discussed to keep subject matter included in Syn. 311–312 up to date.

Syn. 452 SYNTHETIC TEXTILES SEMINAR 2 Credit Hours

Four to five hours per week

Prerequisites: Syn. 301–302, 311–312, 401, 411

A general discussion of the problems encountered in the synthetic textile field, covering economics, manufacture, processing, properties and various aspects of research. Recent advances and projected developments will be covered. Participation by both students and instructors in the seminar is aimed at developing an objective viewpoint of the subject in the student.

TEXTILES — GENERAL

Tex. 101 SURVEY OF TEXTILES 1 Credit Hour

Two lectures per week

This subject is designed to give the student elementary knowledge of the textile industry so that he can choose his future course more intelligently, and so that he can better understand the relations between the various branches of the industry.

Tex. 102 INTRODUCTION TO FIBERS 2 Credit Hours

Two lectures per week

A general survey of the fibers used in the textile industry, including natural cellulosic (soft and hard), protein, and mineral fibers and the man-made fibers. The sources (location and distribution), the economics, and the preparation of the fiber for textile uses will be discussed. An introduction to the elementary properties of fibers making them suitable for specific textiles will also be presented.

Tex. 201–202 TEXTILE MANUFACTURING 6 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisite: Tex. 102

This course is designed for those not majoring in cotton or wool manufacture and covers the basic processes and basic textile manufacturing systems as they relate to all of the important textile fibers. The objective of this course is to develop a fully integrated picture of the significance of textile processes to the effective utilization of the several textile fibers and of the comparative results of each system and/or process.

Tex. 241 LIBRARY 1 Credit Hour

Two hours per week

This is a subject to introduce the student to the effective use of a library and to familiarize him with the past and current sources of information on textile topics.

Tex. 302 PROPERTIES AND APPLICATION OF FABRICS 2 Credit Hours

Two lectures per week

Prerequisite: Des. 101 or 102

This course is designed to acquaint the student with many of the important fabric types in use today for wearing apparel, home furnishings, and industrial uses. An analytical discussion is utilized so that the student may not only identify the fabrics but also understand the significance of the weave, design, yarns, etc., used.

Tex. 311–312 TEXTILE TESTING 6 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisites: Chem. 102, Phys. 202, Math. 102

This course familiarizes the student with the basic physical, chemical, and optical techniques in common use in the textile industry for quality control and in some measure in research. These basic testing tools are integrated with an elementary introduction to statistics and used in the solution of typical problems of textile evaluation.

Tex. 422 METHODS OF RESEARCH 2 Credit Hours

Two hours per week

Prerequisites: Seniors and Graduate Students only

A seminar to familiarize the student with the philosophy and methods of research; current problems in textile research; and in the further use of textile literature.

Tex. 432 FABRIC DEVELOPMENT 2 Credit Hours

Two lectures per week

Prerequisites: Math. 202, Phy. 202, Eng. 321

This subject correlates the engineering properties of textile materials with engineering principles and textile processing to produce fabrics with desired properties. The principles of structure of mechanical fabrics and those in the consumer goods classification are considered.

WEAVING

Weav. 201–202 WEAVING 6 Credit Hours

Two lectures per week

Two two-hour laboratory periods per week

Prerequisite: Des. 102

This course covers all methods of warp preparation and includes cotton, synthetic, woolen, worsted, and mixed fiber yarns. The warp preparation also covers slashing as well as rayon and synthetic soaking. Practical work is carried out on the machinery in the laboratory. The second half of this course deals with weaving on a cam loom, the identification of parts, principal and auxiliary motions, comparison to other type looms, and defects of weaving.

Weav. 211–212 WEAVING 5 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisite: Des. 102

This course is similar to Weav. 201–202, but utilizes less laboratory time.

Weav. 221–222 WEAVING 4 Credit Hours

Two lectures per week

Prerequisite: Des. 102

This course, designed for non-manufacturing majors, includes the same lecture material as Weav. 201–202, but includes no laboratory work other than lecture-demonstrations and assignments.

Weav. 301–302 WEAVING 6 Credit Hours

Two lectures per week

Two two-hour laboratory periods per week

Prerequisite: Weav. 201–202

This course covers dobby weaving and includes single and double index, single and double cylinder, chains, timing, and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics, silk and narrow webbing. This course also covers pile cloth weaving, carpet weaving and leno weaving.

Weav. 311–312 WEAVING 5 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisite: Weav. 211–212

This course is similar to Weav. 301–302, but utilizes less laboratory time.

Weav. 321–322 WEAVING 4 Credit Hours

Two lectures per week

Prerequisite: Weav. 221–222

This course, designed for non-manufacturing majors, includes the same lecture material as Weav. 301–302, but includes no laboratory work other than lecture-demonstration and assignments.

WOOL

Wool 201–202 FIBER PREPARATION 4 Credit Hours

One lecture per week

One two-hour laboratory period per week

Prerequisites: Eng. 102, 112, Chem. 102

A study of fibrous materials which can be processed on the woolen or worsted systems of manufacture. Special emphasis is placed on wool classification; wool scouring, carbonizing, burr picking; raw materials including animal, vegetable, and synthetic fibers and reworked fibers.

Wool 211–212 TOP MAKING 8 Credit Hours

Two lectures per week

Two three-hour laboratory periods per week

Prerequisites: Eng. 102, 112

This course covers the worsted card, back washing, gilling on open and intersecting machines, combing on both French and Noble combs, blending of colors and/or wool and other fibers, tow to top conversion of synthetic fibers, and an analytical study of the properties and classification of top.

Wool 213–214 FIBER PREPARATION AND TOP MAKING 8 Credit Hours

Three lectures per week

One two-hour laboratory period per week

Prerequisite: Tex. 102

This course covers the same lecture material as Wool 201–202 and Wool 211–212, but the laboratory time is considerably reduced. This course is restricted to those not majoring in Course II.

Wool 301–302 WOOLEN YARNS 5 Credit Hours

One lecture per week first semester

Two lectures per week second semester

One three-hour laboratory period per week both semesters

Prerequisite: Wool 202

This course relates to fiber blending, oiling, picking; woolen carding, including a comparison of ring and tape condenser systems; woolen spinning, including both mule and ring spinning machines; twisting, covering yarn conditioning as well as the production of fancy twists and novelty yarns for knitting and weaving.

Wool 311–312 SURVEY OF WOOL MANUFACTURE 2 Credit Hours

Two lectures per week

One hour of laboratory demonstration per week

Prerequisite: Tex. 102

This course is designed for those not majoring in wool manufacture and presents a comprehensive survey of the woolen and worsted processes as they relate to the manipulation of all types of fiber, but with primary emphasis on wool.

Wool 321–322 WORSTED YARNS 9 Credit Hours

Three lectures per week

One three-hour laboratory period per week first semester

Five hours of laboratory second semester

Prerequisites: Wool 202, 212

A study of worsted yarn production, covering further work in top analyses, and a study of the French and English systems of yarn production, including twisting for knitting or weaving yarns.

Wool 323–324 WOOL AND WORSTED YARNS

Four lectures per week first semester

Five lectures per week second semester

One two-hour laboratory period per week

Prerequisite: Wool 312–212

This course covers the same lecture material as Wool 301–302 and Wool 321–322, but the laboratory time is reduced. This course is restricted to those not majoring in Course II.

Wool 411 WOOLEN ORGANIZATION 2 Credit Hours

Two lectures per week

Prerequisites: Wool 302, Des. 233, Chem. 222

Recapitulation of the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system.

Wool 421 WORSTED ORGANIZATION 2 Credit Hours

Two lectures per week

Prerequisites: Wool 322, Des. 233, Chem. 222

Summarization of previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades, to cover balanced mill equipment necessary to produce worsted cloth from top on both English and French systems.

ALUMNI ASSOCIATION

The membership of the alumni association of the Institute is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year. Membership also includes Associate and Honorary classifications.

The Association holds its annual business meeting and banquet in the spring of each year.

Communications should be addressed to Prof. A. Edwin Wells, Executive Secretary, Alumni Office, Lowell Textile Institute.

OFFICERS AND DIRECTORS FOR THE YEAR 1947–1948

J. Milton Washburn, Jr., '21, *President*
A. Chester Clifford, '22, *1st Vice-President*
Raymond T. Stevens, '19, *2nd Vice-President*
A. Edwin Wells, '20, *Secretary-Treasurer*
Ernest P. James, '42, *Assistant Secretary-Treasurer*

ALUMNI FUND COUNCIL

A. Chester Clifford, '22, *Chairman*
Charles W. Churchill, Jr., '32, *Chairman*, Fund Committee
James A. Irvine, '17, *Chairman*, Special Gifts Committee
Nathaniel E. Jones, '21, *Chairman*, Auditing Committee

BOARD OF DIRECTORS

Term ending April 1948

J. Milton Washburn, Jr., '21
Roger C. Griffin, '45
Olin D. Gay, '08
Royal P. White, '04
Herbert W. Wilkinson, '37

Term ending April 1949

Harold E. Clayton, '21
Milton Hindle, '25
Raymond T. Stevens, '19
Richard W. Rawlinson, '31
E. Perkins McGuire, '28

Term ending April 1950

A. Chester Clifford, '22
Simon Shapiro, '34
Edward B. Bell, '24
Frank W. Gainey, '11
Harold W. Leitch, '14

GRADUATES OF 1947

Master of Science in Textile Chemistry

*George Raymond Boule
B.T.C., Lowell Textile Institute, 1942

Carlos Gorenstin
Industrial Chemist, University of Brazil, 1944

Ramanarayan Gangadhar Manudhane
B.Sc., University of Bombay, 1943
L.T.C., Victoria Jubilee Technical Institute, 1945

Alvaro Olyntho do Prado de Mendonca
Industrial Chemist, University of Brazil, 1944

*Arthur Joseph Moreau
B.T.C., Lowell Textile Institute, 1942

Kurt Politzer
Industrial Chemist, University of Brazil, 1944

Devalpalli Hanmanth Rao
M.S., Osmania University, 1944

Ademar Vieira da Rocha
Industrial Chemist, University of Brazil, 1945

Champaklal Chimanlal Shah
B.Sc., University of Bombay, 1943
L.T.C., Victoria Jubilee Technical Institute, 1945

Kirpal Singh
B.A., Punjab University, 1935
F.M.D., Government Institute of Dyeing and Calico Printing, 1937

Jose Fernandes Valente
Industrial Chemist, University of Brazil, 1945

Master of Science in Textile Engineering

John Carroll Busby, Jr.
S.B., University of North Carolina, 1940

Horst Ewaldo Gaensly
C.E., Universidade do Parana, 1943

Yu-Hsuan Liu
S.M., Massachusetts Institute of Technology, 1946

Chia-Ti Yu
B.S., Georgia School of Technology, 1946

Diploma in Cotton Manufacture

Archavir Nalbandian Melkonian

Diploma in Wool Manufacture

John Duncan Campbell
David Bigelow Dolge
Archavir Nalbandian Melkonian
Warren Martin Pettingill, Jr.

Bachelor of Science in Textile Chemistry

Claude Henry Allard
*Bernard Baum
*John Joseph Bernard
John Ernest DeKalb
*Edwin Gottlieb
Henry Joseph LaFrance, Jr.
*George Olivier Langlais
Philip Eugene MacLean
Stillman Dillon McMahon
*Paul Joseph Martin
John Walcott Merrill
Jackson Wentworth Morton
Walter Holden Perry
*Richard Edward Petersen
*Pauline Frances Riordan
*Joseph Hans Rosenbaum
Ann Eileen Sargent

Bachelor of Science in Textile Engineering

Alan Harold Cherenson
Sidney Fishman
*Blanche Annette Gaulin
Isabel Francis Haggerty
*John Lawrence Hallett, Jr.
Stanley Lee Helfgott
Kalman Kaplan
*Julian Bernard Klashman
*Julian Frank Kosowicz
*Leonard Stewart Lauten
Harold Leshowitz
*Robert Gardiner MacIntyre
*Martin Bernard Marcus
Alex Michael Miller
*Robert Ellis Porter
John Hart Queeney

*Tau Epsilon Sigma (Textile Scholastic Society)

REGISTER OF STUDENTS

GRADUATE STUDENTS

Home Address	*Lowell Address*
ABDEL MAKSUD, HUSSEIN, VI, Cairo, Egypt M.E., Fouad 1 University, 1940	20 Varney Street
CHANDRA, PRAKASH, VI, Nagpur, India M.E., Victoria Jubilee Technical Institute, 1946	800 Merrimack Street
CHANG, LEO SHIH-YEN, IV, Shanghai, China B.S., St. John's University, 1944	137 Riverside Street
CONLIN, JAMES JOSEPH, JR., VI, Jersey City, N. J. B.S., U. S. Naval Academy, 1944	26 Fremont Street
EL-GAMMAL, AZIZ ABDEL-KADER, VI, Giza, Egypt E.E., Fouad 1 University, 1943	29 Middlesex Street, No. Chelmsford, Mass.
GIFFLER, BERNARD, VI, Brooklyn, N. Y.	
GODIWALA, RAMSWARUP GULABDAS, IV, Bombay, India B.S., St. Xaviers College, 1943	27 Waverly Street
HALLETT, JOHN LAWRENCE, JR., VI, Boston, Mass. B.S., Lowell Textile Institute, 1947	———
HOCHSCHILD, REINHARD GEORGE, IV, Dracut, Mass. B.T.C., Lowell Textile Institute, 1943	———
IPLIKCI, AHMET YASAR, VI, Eskisehir, Turkey B.S., Robert College, 1946	9 White Street
KELAKOS, CHARLES GEORGE, VI, Lowell, Mass. B.T.E., Lowell Textile Institute, 1938	6 Rockdale Avenue
KNOWLES, YANCEY HENRY, VI, Mt. Olive, N. C. B.S., Virginia Military Institute, 1939	408 Mammoth Road
LANDRY, RITA PEARL, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1946	348 Hildreth Street
LEE, YING-DOONG, VI, Shanghai, China B.S., Nantung College, 1944	272 Merrimack Street
LEE, YING KONG, VI, Shanghai, China B.S., St. John's University, 1944	43 Plymouth Street
MCWHORTER, JOHN CALVIN, JR., VI, Edinburg, Texas B.S., U. S. Military Academy, 1946	23 Fremont Street
MARDER, SOLOMON, VI, Rock Island, Illinois B.S., Cornell University, 1946	50 Standish Street
MEEHAN, JOSEPH ARNOLD, VI, Wollaston, Mass. B.S., Tufts College, 1945	91 Methuen Street

Home Address	*Lowell Address*
NANDA, DHARAMPAL AMARNATH, VI, Bombay, India B.S., Bombay University, 1942	28 Riverside Street
POSPISIL, JAROMIR JAN, VI, Wilber, Nebraska B.S., U. S. Military Academy, 1930	30 Parkview Avenue
QUO, TSE-BIE, VI, Shanghai, China B.S., Chiao Tung University, 1939	272 Merrimack Street
SCOTT, ROBERT LEE, VI, Dallas, Texas B.S., University of Texas, 1941	30 Parkview Avenue
SOLANKI, UTTAMLAL VAGHJI, IV, Bombay, India B.S., University of Bombay, 1938	25 Third Street
VAUGHN, WILLIAM ENOCH, JR., VI, Atlanta, Ga. B.S., Georgia School of Technology, 1939	883 Westford Street
VOONG, EDITH TSE-LIEU, VI, Shanghai, China B.S., Nantung College, 1944	50 John Street
WILLETT, ROBERT EARLE, IV, Alexandria, Va. B.S., North Carolina State College of Agriculture and Engineering, 1938	172 Robin Hill Road, So. Chelmsford
WOO, HENRY KYI-OEN, IV, Shanghai, China B.S., St. John's University, 1939	56 Fourth Avenue
WOODARD, WILLIAM KENNETH, VI, Atlanta, Ga. B.S., Georgia School of Technology, 1943	8 Thissell Ave., Dracut
YANG, YUAN-LOONG, IV, Shanghai, China B.S., St. John's University, 1943	775 Bridge Street

Class of 1948

Home Address	*Lowell Address*
Bardzik, John Walter, IV, Dracut, Mass.	———
Bauer, Jerome Frederick, IV, Waterloo, Ontario	406 Pawtucket Street
Bianco, AlbertLawrence, IV, East Paterson, N. J.	393 High Street
Bisko, Stephen John, VI, Dorchester, Mass.	406 Pawtucket Street
Boule, Wilfred Leo, IV, Lowell, Mass.	66 Mt. Hope Street
Chan, Ping Chao, VI, Kunming, China	43 Plymouth Street
Clogston, Samuel Leighton, VI, Lowell, Mass.	152 Wentworth Avenue
Fain, Samuel Zachary, VI, New York, N. Y.	392 Chelmsford Street
Farren, Roger Patrick, IV, Medford, Mass.	———
Foley, Eleanor Elizabeth, IV, Lowell, Mass.	120 Fulton Street
Frank, Allen Morris, IV, Lowell, Mass.	25 Canton Street
Glade, Nathaniel Henry, IV, Lowell, Mass.	137 Riverside Street
Grime, Norman Brown, VI, Swansea, Mass.	North Tewksbury
Hagerty, Francis William, VI, Lexington, Mass.	———
Helland, Howard Manley, VI, Whitinsville, Mass.	11 White Street
Hirn, John Edward, Jr., IV, East Hartford, Conn.	184 Eleventh Street
Howland, Henry Talmadge, VI, Skaneateles, N. Y.	457 Westford Street
Hoyle, Albert Gerard, IV, Lowell, Mass.	128 Mt. Hope Street
Kennedy, James Harrington, 3rd, VI, Lowell, Mass.	43 Florence Avenue
King, James Robert, VI, Tewksbury, Mass.	———
Kopycinski, Joseph Valentine, IV, Lowell, Mass.	242 Branch Street
Landry, Charles Joseph, VI, Lowell, Mass.	348 Hildreth Street
Leitch, John Badger, VI, Andover, Mass.	———
Levin, Jordan, VI, Lowell, Mass.	141 East Merrimack Street
McKittrick, Vernon Russell, VI, Lowell, Mass.	10 Belmont Street
McKniff, John Thomas, IV, Forge Village, Mass.	———
McKone, Peter Joseph, Jr., IV, Lowell, Mass.	29 Orleans Street
McNally, Alan Martin, IV, Dracut, Mass.	———
Meister, Robert Benjamin, IV, Maynard, Mass.	100 Mt. Washington Street
Morel, Gerard Charles, IV, Andover, Mass.	92 Colonial Avenue
Murphy, George Campbell, IV, Buffalo, N. Y.	406 Pawtucket Street
Na, Chung-sheng, IV, Kunming, China	43 Plymouth Street.
O'Donnell, James Francis, IV, No. Chelmsford, Mass.	———
O'Flahavan, James Michael, IV, Lowell, Mass.	62 Colonial Avenue
Penner, Stuart Emanuel, IV, Lawrence, N. Y.	393 High Street
Reynolds, James Michael, IV, Lowell, Mass.	3 Concord Place
Roughan, John Michael, IV, Lowell, Mass.	176 Andover Street
Shann, William Edwin, VI, Andover, Mass.	———
Siegel, Melvin, VI, New York, N. Y.	392 Chelmsford Street
Simon, Richard Bernard, IV, New York, N. Y.	77 Livingston Avenue
Smoler, Irwin Charles, VI, New York, N. Y.	77 Livingston Avenue
Spofford, Ray Milton, VI, Haverhill, Mass.	———
Werkowski, Stanley Joseph, VI, Lowell, Mass.	175 Fort Hill Avenue
Wielicka, Edward Dominic, IV, Lawrence, Mass.	———
Wilkinson, Vernon Lee, VI, Lawrence, Mass.	———

Class of 1949

Affler, Manuel, VI, Montreal, Quebec	77 Livingston Avenue
Alden, John, VI, Lowell, Mass.	45 Harvard Street

Home Address	*Lowell Address*
Aslanoglou, George Leomidas, VI, Athens, Greece	43 Plymouth Street
Bess, Leon, V, Paterson, N. J.	42 So. Walker Street
Bill, Walter Edgar, IV, Lowell, Mass.	17 Plain Street
Blackman, Harvey Bernard, VI, Brockton, Mass.	25 Princeton Blvd.
Braff, Stanford Wolf, VI, Brooklyn, N. Y.	142 Riverside Street
Brassil, Robert Daniel, IV, Lowell, Mass.	404 Wentworth Avenue
Britton, Edward Joseph, IV, Lowell, Mass.	21 Hurd Street
Brown, Russell Lee, Jr., VI, Lowell, Mass.	59 Bradstreet Avenue
Callahan, Daniel Francis, IV, Lowell, Mass.	26 Second Avenue
Carpenter, Bryant Locke, VI, Rockland, Mass.	47 Forest Street
Charatz, Milton, IV, Brooklyn, N. Y.	42 So. Walker Street
Cherowbrier, Edward, Jr., IV, Methuen, Mass.	———
Colman, Alexander Herman, VI, New York, N.Y.	77 Livingston Avenue
Davis, James Edward, VI, Toronto, Ontario	51 Orchard Street
DeAngelis, Louis Paul, VI, Old Forge, Pa.	100 Mt. Washington Street
DeMallie, Stephen Potter, VI, Lowell, Mass.	275 Gibson Street
Downing, Parker Willard, IV, Ayer, Mass.	———
Duffy, Joseph Gordon, VI, Lawrence, Mass.	———
Dulack, Joseph Thomas, Jr., VI, Somersville, Conn.	439 Varnum Avenue
Eliyesil, Mehmet Can, VI, Tarsus, Turkey	123 Riverside Street
Feltheimer, Arthur Murray, VI, Bronx, N. Y.	330 Stevens Street
Field, Marvin Joseph, VI, Yonkers, N. Y.	123 Riverside Street
Fishman, Maurice, IV, Roxbury, Mass.	42 So. Walker Street
Foley, William Matthew, IV, Lowell, Mass.	120 Fulton Street
Fox, Richard Coleman, VI, Lowell, Mass.	27 Royal Street
Fraser, Richard Warren, VI, Melrose, Mass.	43 Plymouth Street
Friedlander, Robert, VI, Brooklyn, N. Y.	39 West Street
Fruchtman, Gerald Gary, VI, Brooklyn, N. Y.	14 Oakland Street
Gardner, Lawrence Carroll, IV, Lowell, Mass.	48 Sutherland Street
Giglio, Frank Antonio, VI, Brooklyn, N. Y.	298 Riverside Street
Gilchrest, Dexter Stuart, VI, Beverly, Mass.	406 Pawtucket Street
Godet, John Russell, IV, Lowell, Mass.	71 Agawam Street
Gordon, David Albert, IV, Lowell, Mass.	173 Branch Street
Gottlieb, Seymour, VI, Brooklyn, N. Y.	77 Mt. Washington Street
Greenberg, Bernard, III, Brooklyn, N. Y.	417 Wilder Street
Greene, Philip Leon, VI, Brooklyn, N. Y.	77 Livingston Avenue
Gregg, Julian Barnes, VI, Worcester, Mass.	406 Pawtucket Street
Gruber, Phillip Arthur, IV, Lowell, Mass.	57 Corbett Street
Guggenheim, Leopoldo Levi, VI, Santiago, Chile	15 Douglas Road
Gunther, Marilyn Katherine, IV, Dracut, Mass.	———
Hallett, Richard Libby, VI, Lowell, Mass.	98 Wannalancit Street
Handy, William Lafayette, VI, Longmeadow, Mass.	———
Harvey, Clifford Arthur, IV, Lowell, Mass.	36 Woodward Terrace
Haskel, Simon Aaron, VI, Brooklyn, N. Y.	77 Livingston Avenue
Huff, Thomas Augustus, VI, West Coast, B. C.	54 Mt. Grove Street
Illingworth, Sam Groveham, V, West Newton, Mass.	———
Kane, James Francis, VI, Lowell, Mass.	37 Unsworth Street
Kavouras, Christos Nikitas, VI, Lowell, Mass.	5 Hancock Avenue

Home Address	*Lowell Address*
Keeney, John Henry, VI, Somersville, Conn.	406 Pawtucket Street
Kenniston, George Demeritt, IV, Lowell, Mass.	67 Loring Street
King, John Michael, Jr., VI, Lowell, Mass.	158 Howard Street
Koksal. Lutfu, VI, Istanbul, Turkey	123 Riverside Street
Kosartes, Marina, VI, Lowell, Mass.	1036 Middlesex Street
Krivis, Ernest, VI, Brookline, Mass.	———
Lachut, Herbert Michael, IV, Dracut, Mass.	———
Lapidus, Charles Henry, IV, Brooklyn, N. Y.	77 Livingston Avenue
Lash, Seymour Leon, VI, Bronx, N. Y.	61 Twelfth Street
Lent, Roy Gordon, VI, Maynard, Mass.	406 Pawtucket Street
Lesser, Stanley Baker, VI, Brooklyn, N. Y.	239 Stevens Street
Liverant, Manfred Joachim, VI, Montreal, Canada	2 Bellevue Street
Luz, Victor James, VI, Lowell, Mass.	1122 Gorham Street
McCartin, John Peter, VI, Lowell, Mass.	611 Stevens Street
McMahon, Laurence Francis, IV, Lowell, Mass.	7 Belmont Street
Maguire, John Paul, VI, Lowell, Mass.	31 Prospect Street
Manning, Edward Nicholas, IV, Cambridge, Mass.	406 Pawtucket Street
Martin, James Frank, VI, Lowell, Mass.	53 Fay Street
Mitchell, Alvin Emery, IV, Warwick, R. I.	272 Merrimack Street
Natter, Sidney, VI, Lowell, Mass.	173 Branch Street
Nystrom, Frederick Walter, VI, W. Chelmsford, Mass.	———
Peirent, Robert John, IV, Dracut, Mass.	———
Pfister, David Herbert, V, Lynbrook, N. Y.	31 Waverly Avenue
Piekarski, William Fabian, IV, Lowell, Mass.	179 Hildreth Street
Pinto, Americo Seabra Moura, VI, Rio de Janeiro, Brazil	39 Chelmsford Street
Polebaum, Eugene Harvey, VI, Brooklyn, N. Y.	52 Princeton Blvd.
Renaux, Ingo Arlindo, VI, Brusque, Brazil	392 Chelmsford Street
Rhodes, Max, IV, Queens, N. Y.	77 Livingston Avenue
Richardson, Donald Forrest, VI, Lowell, Mass.	53 Dunfey Street
Riordan, Warren Paul, Jr., VI, Lowell, Mass.	21 Orchard Street
Rosa, Manuel August, VI, Methuen, Mass.	———
Roy, Raymond Emil, IV, Lowell, Mass.	95 Jeness Street
Sayers, Thomas Martin, VI, Lowell, Mass.	27 Burtt Street
Schwarz, Walter, VI, Elmhurst, L. I., N. Y.	272 Merrimack Street
Segall, William Martin, IV, Lowell, Mass.	111 Luce Street
Shapiro, Sumner, VI, Lowell, Mass.	37 Canton Street
Shaughnessy, John Andrew, IV, Lowell, Mass.	18 Puffer Street
Sheehan, Charles Russell, IV, Lowell, Mass.	374 Adams Street
Stavrakas, Evangelos, V, Brooklyn, N. Y.	31 Waverly Avenue
Stillman, Edward Isaac, VI, Shaker Heights, Ohio	142 Riverside Street
Strobel, Richard Irving, IV, Lawrence, Mass.	———
Stroup, John Francis, Jr., IV, Boston, Mass.	304 Salem Street
Sugg, Philip Willson, VI, Lisbon Falls, Me.	406 Pawtucket Street
Sullivan, John Edward, VI, Lowell, Mass.	280 Beacon Street
Sweeney, James William, IV, Lowell, Mass.	318 Adams Street
Trommer, Charles Richard, IV, New York, N. Y.	392 Chelmsford Street
Vomvouras, Paul, VI, Dorchester, Mass.	406 Pawtucket Street
Weinstein, Manuel, VI, Revere, Mass.	43 Plymouth Street

Home Address	*Lowell Address*
WEISER, JOHN BENNO, VI, Elmhurst, N. Y.	26 Crawford Street
WEISS, DONALD STUART, V, Bronz, N. Y.	25 Princeton Boulevard
WILBUR, EARL RAYMOND, IV, Lowell, Mass.	172 Shaw Street
WOODWARD, PAUL HENRY, VI, Lebanon, N. H.	392 Chelmsford Street
YOUNG, WILLIAM ARTHUR, VI, Toronto, Canada	476 Varnum Avenue
YUMLU, MUSTAFA EKREM, VI, Istanbul, Turkey	35 Varnum Avenue

CLASS OF 1950

ABBOTT, GEORGE AMOS, II, Malden, Mass.	466 Bridge Street
ADLER, KENNETH MYRON, VI, Brooklyn, N. Y.	306 Wilder Street
ALLY, ROGER EDWARD, VI, Lowell, Mass.	Fanning Street
ALPERT, EUGENE OLIVER, II, Brooklyn, N. Y.	65 Bellevue Street
ANDREWS, HUGH HILL, VI, Andover, Mass.	———
ANGELO, PAUL JOSEPH, JR., VI, Nashua, N. H.	———
AUGSBURGER, GERARDO RAINER, I, Buenos Aires, Argentina	59 Arlington Street
BECKER, RICHARD JOHN, I, Lowell, Mass.	34 Crowley Street
BESSO, MICHAEL MAURICE, IV, Brooklyn, N. Y.	109 Mammoth Road
BLAGMAN, BURTON, IV, Brooklyn, N. Y.	77 Livingston Avenue
BONCZAR, THADDEUS JOSEPH, VI, Lowell, Mass.	130 Jewett Street
BOOK, BERNARD SAMUEL, III, New York, N. Y.	263 Princeton Blvd.
BOUDREAU, PAUL VICTOR, IV, Lowell, Mass.	295 Riverside St.
BOWDEN, ALANSON WALKER, JR., II, Bethel, Maine	10 Tyler Street
BRECK, WENDELL HERBERT, II, Dracut, Mass.	———
BRESSLER, SIDNEY WALLACE, V, Brockton, Mass.	52 Princeton Boulevard
BROWN, JUDITH ANNE, IV, Georgetown, Mass.	John Street
BROWN, WALTER MADISON, II, Worcester, Mass.	34 Arlington Street
BROWNELL, SUMNER IVES, I, Moodus, Conn.	262 Pawtucket Street
BRUCE, DENNIS WILLIAM, IV, Verdun, Quebec	406 Pawtucket Street
BRUNELLE, NORMAN MATTHEW, IV, Fitchburg, Mass.	53 Fourth Avenue
CALLAN, STEPHEN SMITH, VI, Reading, Mass.	———
CANOVA, ALFRED WILLIAM, VI, Holyoke, Mass.	31 Waverly Avenue
CARTER, FRED DOLGE, III, Millbury, Mass.	31 Waverly Avenue
CASEY, JOHN GERARD, VI, Pittsfield, Mass.	418 Walker Street
CASEY, THOMAS GARRETT, IV, Lowell, Mass.	8 Gates Street
CASTORIANO, ALEX, I, Lima, Peru	222 Varnum Avenue
CASTORIANO, CLAUDE EMANUEL, I, Lima, Peru	272 Merrimack Street
CHADWICK, THOMAS NEILSON, VI, Lowell, Mass.	57 Robbins Street
CHAO, PEI CHUNG, I, Shanghai, China	12 Warwick Street
CLIFFORD, STANLEY JOSEPH, II, West Roxbury, Mass.	418 Walker Street
COHEN, STANLEY ROBERT, VI, Mattapan, Mass.	32 Orchard Street
COMMERFORD, THERESE RITA, IV, Lowell, Mass.	29 Starbird Street
CONLON, WILLIAM HENRY, IV, Lowell, Mass.	101 Walker Street
COPP, ALBERT RAYMOND, IV, Hudson, Mass.	28 Riverside Street
CUMMINGS, ROBERT EDWARD, VI, Enfield, Conn.	5 White Street
DERBY, JAMES HENRY, II, Lawrence, Mass.	———
DOLE, GORDON SHATTUCK, VI, Bristol, N. H.	400 Westford Street
DOUGLAS, WARREN DANA, VI, Lowell, Mass.	30 Burgess Street
DUBIN, PAUL, VI, Worcester, Mass.	65 Bellevue Street

Home Address	*Lowell Address*
Dulken, John Frederick, VI, Montclair, N. J.	31 Waverly Avenue
Earls, Robert Kimball, VI, Southbridge, Mass.	956 Lakeview Avenue
Ellis, Lawrence Francis, II, Melrose, Mass.	406 Pawtucket Street
Ellis, Ralph Jefford, VI, Newton Highlands, Mass.	661 Rogers Street
Evans, John, IV, East Boston, Mass.	31 Waverly Avenue
Evans, William George, IV, East Boston, Mass.	31 Waverly Avenue
Farley, Glenn Robert, VI, North Andover	———
Favro, Gilbert James, IV, Lowell, Mass.	19 Potter Street
Feinman, Jerome Harold, VI, Bronx, N. Y.	32 Orchard Street
Feldman, Manuel David, V, Lynn, Mass.	320 Wilder Street
Feyler, Donald Pearson, IV, Chelmsford, Mass.	———
Feyler, Irvine Wyman, Jr., IV, Chelmsford, Mass.	———
Fifield, Richard Tyler, VI, Melrose, Mass.	———
Fillmore, Malcolm Graham, Jr., VI, Melrose, Mass.	———
Fishback, Joseph, V, Roackaway Beach, N. Y.	77 Livingston Avenue
Flister, Walter Edwin, IV, Hyde Park, Mass.	31 Waverly Avenue
Fleisher, Conrad, Gerald, IV, Watertown, Conn.	70 Livingston Avenue
Fowle, Frederick Jordon, II, Wellesley, Mass.	31 Waverly Avenue
Fox, Julius Ira, VI, Philadelphia, Penn.	418 Westford Street
Gaidis, Leo Peter, IV, Lawrence, Mass.	———
Gaon, Harry, VI, Montreal, Canada	77 Livingston Avenue
Gellis, Donald Ian, VI, Laurelton, N. Y.	59 Arlington Street
Glass, Arthur Marvin, VI, Providence, R. I.	53 Mount Hope Street
Glassman, Herbert, II, Boston, Mass.	33 Dover Street
Goldman, Alfred Yale, V, Chelsea, Mass.	53 Mt. Hope Street
Goldman, Sumner Bernard, I, Roxbury, Mass.	117 Grand Street
Gouveia, Adelino Peter, IV, Lowell, Mass.	161 Lawrence Street
Gregg, Joan Louise, IV, Lowell, Mass.	1867 Middlesex Street
Grochmal, Stanley Joseph, IV, Lowell, Mass.	46 Albion Street
Hacker, Morton, VI, Lowell, Mass.	7 Rockdale Avenue
Halligan, Raymond Earl, IV, Lowell, Mass.	180 Smith Street
Hathorne, Berkley Charles, VI, Reading, Mass.	———
Hebert, Raymond Lucien, IV, Lawrence, Mass.	———
Hekker, Frank Henry, IV, Rutherford, N. J.	406 Pawtucket Street
Herbert, Erwin Lori, VI, Elizabeth, N. J.	272 Merrimack Street
Higgins, William Eugene, VI, Lowell, Mass.	682 Lawrence Street
Higuera, Cristobol Hernandez, II, Mexico	278 Central Street
Hitchcock, Ralph William, II, Waltham, Mass.	272 Merrimack Street
Hornyak, Frederick Mathew, IV, Philadelphia, Pa.	155 Pleasant Street, Dracut
Horwitz, Edward Melvin, VI, Utica, N. Y.	35 Varnum Avenue
Kaufman, David Leonard, II, Denver, Colo.	100 Mt. Washington Street
King, Richard McClain, VI, Shawnee, Okla.	275 Gibson Street
Koffman, Leonard Saunders, III, Roxbury, Mass.	392 Chelmsford Street
Kormos, Peter Marion, V, New Brunswick, N. J.	205 Stackpole Street
Koshak, Daniel Theodore, IV, Brooklyn, N. Y.	262 Adams Street
LaRiviere, Stephen Gerard, III, Southbridge, Mass.	30 Riverside Street

Home Address	*Lowell Address*
Laureti, Remo Joseph, VI, Quincy, Mass.	457 Westford Street
Lebowitz, Myer, VI, Boston, Mass.	457 Westford Street
Leitgeb, Donald Joseph, V, Waldwick, N. J.	406 Pawtucket Street
Lemire, Gabrielle Marie, IV, Lowell, Mass.	52 Colonial Avenue
Levinson, Arthur David, VI, Brooklyn, N. Y.	77 Livingston Avenue
Liberty, William Wallace, VI, Quechee, Vt.	44 Harvard Street
Lorberbaum, Alan Saymour, I, New York, N. Y.	16 Van Greenby Road
Lord, Edwin Lincoln, Jr., VI, Medford, Mass.	457 Westford Street
McCarron, Dorothy Anne, IV, Lowell, Mass.	416 Rogers Street
McGowan, Malcolm, IV, Lowell, Mass.	262 Shaw Street
McKone, Henry James, VI, Lowell, Mass.	27 Woodward Avenue
Mahoney, Herbert Francis, IV, Winchester, Mass.	66 Riverside Street
Majeune, Gaston Christian, IV, Bradford, Mass.	———
March, Peyton Conway, VI, Melrose, Mass.	———
Mark, Regina, V, Baltimore, Maryland	50 John Street
Matlin, Nathaniel Abraham, IV, Brooklyn, N.Y.	48 Gates Street
Meltzer, Richard Morris, VI, New York, N. Y.	272 Merrimack Street
Merrill, Allen Robert, VI, Lowell, Mass.	30 Cabot Street
Middleton, Donald Whiting, VI, Rehoboth, Mass.	12 Crawford Street
Milgrim, Seymour, V, Brooklyn, N. Y.	77 Livingston Avenue
Miller, James Edward, IV, Leavenworth, Kansas	12 Crawford Street
Morrison, Robert Eugene, IV, Dracut, Mass.	———
Newman, Jerome Leonard, VI, Brooklyn, N. Y.	32 Dover Street
O'Donoghue, John Francis, Jr., II, Belmont, Mass.	———
O'Krafka, Alfred Ernest, II, Hespeler, Ontario	75 Smith Street
O'Neil, John Joseph, Jr., II, Arlington, Mass.	12 Crawford Street
Paul, Vito John, VI, Lawrence, Mass.	———
Peterson, John Samuel, VI, Andover, Mass.	———
Pong, William, I, Pine Bluff, Ark.	137 Riverside Street
Priestley, Joseph Amos, VI, Lowell, Mass.	511 Bridge Street
Profio, Samuel Camillo, IV, Lowell, Mass.	1878 Middlesex Street
Proulx, Raymond Elphege, III, Lowell, Mass.	17 Dodge Street
Ramsbottom, John Dana, Jr., I, Fall River, Mass.	406 Pawtucket Street
Rawitz, Leonard, VI, Roxbury, Mass.	392 Chelmsford Street
Rebenfeld, Ludwig, IV, Jackson Heights, N. Y.	263 Princeton Boulevard
Reines, William, IV, Poughkeepsie, N. Y.	272 Merrimack Street
Rivollier, Elie, Jr., V, Clinton, Mass.	320 Wilder Street
Rodgers, Charles Joseph, Jr., IV, Lowell, Mass.	14 Dumerle Street
Rudes, Sidney, V, Brooklyn, N. Y.	77 Livingston Avenue
Rudolf, Mitchell Joseph, VI, Lowell, Mass.	5 Hazel Square
Ruffenach, Stephen Clifford, IV, Paterson, N.J.	83 Stevens Street
Samdperil, Albert, VI, Providence, R. I.	392 Chelmsford Street
Sampson, Walter Stewart, Jr., VI, Belmont, Mass.	———
Shenkar, Shmaryahn Barukh, VI, Holon, Palestine	262 Merrimack Street

Home Address	*Lowell Address*
Shires, William Stanley, VI, Lowell, Mass.	18 Gage Avenue
Sloan, Robert Hood, VI, Tewksbury, Mass.	————
Smaha, Herbert Joseph, IV, Methuen, Mass.	————
Snow, Ralph Frank, VI, Montreal, Quebec	169 Wentworth Avenue
Sorkin, Saul, VI, Brooklyn, N. Y.	272 Merrimack Street
Sosebee, Donald Winston, II, Newport, N. H.	31 Waverly Avenue
Spencer, Robert Weeks, II, Saylesville, R. I.	37 Varney Street
Spicer, George William, IV, Lowell, Mass.	19 Rhodora Street
Struzik, Frank Broneslaw, VI, Woonsocket, R.I.	98 Stevens Street
Sweetser, Paul Ashton, VI, North Quincy, Mass.	————
Teubal, Michael Neville, II, Buenos Aires, Argentina	222 Varnum Avenue
Volin, Irwin Jack, II, Lawrence, N. Y.	393 High Street
Webster, Charles Clifford, VI, Lowell, Mass.	225 Foster Street
Weiner, Charles Richard, III, Brooklyn, N. Y.	77 Livingston Avenue
Welcome, William Francis, IV, Lowell, Mass.	105 Lauriat Street
Weldon, Joseph Edward, IV, Lowell, Mass.	72 Lafayette Street
West, Albert George, VI, Whitinsville, Mass.	418 Walker Street
Williams, John Woodburn, II, Perth, Ontario	148 Riverside Avenue
Wirth, Allan Robert, IV, Lawrence, Mass.	————
Woidzik, Albert Thomas, VI, Pringle, Pa.	59 Crescent Street

Class of 1951

Abbot, Edward Moseley, II, Westford, Mass.	————
Abrahamson, David Marshall, III, Worcester, Mass.	100 Mt. Washington Street
Anthony, Robert Manning, IV, Lowell, Mass.	182 South Street
Athas, Stanley Theodore, VI, Lowell, Mass.	138 Bowers Street
Bacon, Corinne Holt, IV, Dunstable, Mass.	————
Barretto, Eugene John, VI, Westford, Mass.	————
Bazakas, Apostolos Christos, VI, Marlboro, Mass.	37 Varney Street
Belsik, Paul Harold, V, Averne, N. Y.	77 Livingston Avenue
Bergeron, Roger Lionel, VI, Lowell, Mass.	157 Nesmith Street
Bergman, Walter David, VI, Boston, Mass.	245 Foster Street
Berwick, Robert Lloyd, VI, New York, N. Y.	21 Dunbar Avenue
Bickford, Robert Donald, II, Readfield, Maine	84 Bellvue Street
Bischoff, Frederick Bedell, VI, Wilmington, Mass.	————
Bloomenfeld, Joseph, VI, Brooklyn, N. Y.	293 Shaw Street
Boghosian, Nishan, VI, Whitinsville, Mass.	31 Waverly Avenue
Briggs, Gilbert, Jr., IV, Lawrence, Mass.	————
Brosnan, Martin John, IV, Lowell, Mass.	20 Genest Avenue
Brown, Frederick Donald, IV, Lowell, Mass.	24 Viola Street
Buchanan, Warren Thomas, VI, No. Chelmsford, Mass.	————
Bullock, Robert Joseph, VI, Arlington, Mass.	————
Burns, Edward Charles, IV, Lowell, Mass.	511 Westford Street
Bush, Norman Fitz, II, Dresden, Ohio	87 Nesmith Street
Cassidy, Paul Conlon, IV, Lowell, Mass.	182 Wentworth Avenue
Cate, Alfred Louis, IV, Lawrence, Mass.	————

Home Address	*Lowell Address*
Chace, William George, Jr., VI, Westford, Mass.	————
Charewicz, Joseph Henry, VI, Lawrence, Mass.	————
Churchville, Joseph John, II, Townsend, Mass.	476 Varnum Avenue
Cook, Sumner Norman, II, Brookline, Mass.	418 Westford Street
Coombes, Richard William, VI, Tewksbury, Mass.	————
Corcoran, Henry James, Jr., II, Newton Lower Falls, Mass.	53 Mt. Hope Street
Cottrell, Robert Charles, IV, Lowell, Mass.	103 So. Walker Street
Covington, Frederick Arthur, IV, Lowell, Mass.	1268 Middlesex Street
Craven, Francis Joseph, Jr., IV, Lowell, Mass.	620 School Street
Creegan, Robert Michael, IV, Lowell, Mass.	31 Morey Street
Crockford, George William, Jr., IV, Fitchburg, Mass.	————
Cushman, Paul Swan, VI, Glens Falls, N. Y.	21 Dunbar Avenue
Daigle, Joseph Paul, IV, Lowell, Mass.	10 Shea Street
Daveau, Norman Oliver, I, Webster, Mass.	14 Livermore Street
Davis, Evans Reade, VI, Toronto, Ont.	16 Tyler Park
Denio, Ruth Elinor, IV, Lowell, Mass.	129 B. Street
Deschamps, Joseph Raymond, VI, Lawrence, Mass.	————
Descoteaux, Paul Maurice, VI, Lowell, Mass.	104 Cabot Street
Dooley, Donald David, IV, Lowell, Mass.	799 Chelmsford Street
Dowling, Edward Malley, IV, Wilmington, Mass.	————
Driscoll, William Joseph, Jr., IV, Lawrence, Mass.	————
Ducharme, Joseph James, IV, Lowell, Mass.	166 Smith Street
Dufresne, John Emilian, I, Blackstone, Mass.	53 Mt. Hope Street
Duncan, Blair Robertson, IV, Easthampton, Mass.	9 Dunbar Avenue
Dupuis, Amedee James, VI, Lowell, Mass.	26 Freemont Street
Durgin, Bertrand Horace, IV, Lowell, Mass.	12 Crane Street
Eklund, Clinton Louis, VI, Lowell, Mass.	137 Midland Street
Feitelson, Herbert William, VI, New York, N. Y.	53 Mt. Hope Street
Ferron, Richard Edward, VI, Belmont, Mass.	128 Freemont Street
Finklestein, Martin Isaac, IV, Paterson, N. J.	37 Ware Street
Fitzgerald, Robert Antoin, VI, Belmont, Mass.	29 Wedge Street
Flanagan, Francis Kevin, IV, Lowell, Mass.	60 Fort Hill Avenue
French, Gerald William, VI, Lowell, Mass.	55 Varnum Street
Gellene, Alfred Vincent, IV, Paterson, N. J.	106 Billings Street
Genest, Albert Arthur, VI, Lowell, Mass.	638 Market Street
Georgekakos, James George, VI, Lowell, Mass.	405 Broadway
Gilman, Leonard Irwin, IV, Boston, Mass.	————
Girard, Roger Donald, V, Lowell, Mass.	243 White Street
Girouard, Paul Charles, VI, Dorchester, Mass.	26 Draper Street
Glidden, John Edwin, II, Beverly, Mass.	77 Mt. Washington Street
Goldberg, Murray Myles, VI, Providence, R. I.	77 Livingston Avenue
Goldstein, Morton Irwin, VI, Springfield, Mass.	77 Mt. Washington Street
Goodwin, Dorrance Haven, VI, Sanford, Maine	Westford, Mass.
Gorecki, Charles Edward, VI, Haverhill, Mass.	————
Goulekas, Charles Andrew, VI, Lowell, Mass.	67 Varney Street
Gouveia, Seraphin Anthony, IV, Lowell, Mass.	161 Lawrence Street

Home Address	*Lowell Address*
Greenberg, Gerald Mark, IV, Brooklyn, N. Y.	417 Wilder Street
Guidotti, Alfred Edward, II, Newport, N. H.	31 Waverly Avenue
Gunther, Elizabeth Lorraine, IV, Dracut, Mass.	———
Haley, Philip Wesely, VI, Quincy, Mass.	100 Mt. Washington Street
Halpern, Melvin Arthur, VI, New York, N. Y.	37 Varney Street
Hayes, John Thomas, V, Cambridge, Mass.	109 Billings Street
Higgins, Thomas David, VI, Milton, Mass.	37 Varney Street
Hirschhorn, Gerard, VI, Brooklyn, N. Y.	293 Shaw Street
Hochberg, Edward George, VI, Paterson, N. J.	53 Nesmith Street
Holmberg, Harry Harmon, VI, Milford, Mass.	31 Waverly Avenue
Hoyle, Robert Henry, IV, Chelmsford, Mass.	———
Inganamort, Frank Joseph, V, Teaneck, N. J.	15 Douglas Road
Jackle, Roger Williams, II, Springfield Gardens, N. Y.	37 Varney Street
Jacobs, John Francis, Jr., V, North Billerica, Mass.	———
Johnson, Paul Lester, VI, Dorchester, Mass.	230 W. Meadow Road
Karpoff, David, II, New York, N. Y.	392 Chelmsford Street
Kearney, Charles Wallace, IV, Lawrence, Mass.	366 Walker Street
Keith, Richard Canover, II, Putnam, Conn.	137 Wentworth Avenue
Kelleher, John James, IV, Lowell, Mass.	14 Prince Terrace
Kelley, Edward Francis, II, No. Billerica, Mass.	———
Kelley, George Ernest, VI, Lowell, Mass.	166 Shaw Street
Knight, John Henry, II, Billerica, Mass.	———
Kohnfelder, Charles Harry, VI, Springfield, Mass.	392 Chelmsford Street
Kosowicz, Walter John, IV, Lowell, Mass.	5 Jewett Street
Labrecque, Leo Eugene, IV, Lawrence, Mass.	———
Landis, Melvin Bernard, VI, Springfield, Mass.	117 Grand Street
Landry, Arthur Ernest, Jr., IV, Lowell, Mass.	187 White Street
Latkowitch, Sydney Abraham, VI, Chelsea, Mass.	———
Lawson, Wayne Herbert, IV, Lowell, Mass.	12 Puffer Street
Levenson, Albert Milton, IV, Mattapan, Mass.	25 Canton Street
Linberg, Charles Francis, VI, Carney's Point, N. J.	21 Dunbar Avenue
Little, Charles Abbott, III, Winthrop, Mass.	137 Riverside Street
Luba, Marvin, VI, New York, N. Y.	293 Shaw Street
Lyons, Allan Stuart, VI, New York, N. Y.	417 Wilder Street
McComish, James Munro, VI, Lawrence, Mass.	———
McKone, Thomas Joseph, IV, Dracut, Mass.	———
McKone, Vincent Joseph, IV, Lowell, Mass.	29 Orleans Street
McNulty, Denis Michael, II, Dorchester, Mass.	26 Draper Street
Maguire, Thomas Joseph, VI, Lowell, Mass.	31 Prospect Street
Menzies, William Cornet, Jr., VI, Adams, Mass.	207 Mammoth Road
Merrill, George Leslie, IV, No. Chelmsford, Mass.	———
Merrill, Kenneth Stephen, VI, Lowell, Mass.	364 Varnum Avenue
Miller, Arthur Paul, VI, Salt Lake City, Utah	9 Dunbar Avenue
Miller, Kenneth Edward, II, Lawrence, Mass.	64 Mt. Hope Street
Miner, Harvey Oscar, Jr., VI, Amesbury, Mass.	100 Mt. Washington Street
Monaco, Albert Thomas, VI, Quincy, Mass.	457 Westford Street

Home Address	*Lowell Address*
Morrill, Robert Richard, II, Reed's Ferry, N. H.	31 Waverly Avenue
Mountain, Harold Ronald, II, Dexter, Maine	50 Standish Street
Murmes, Leonard, II, Brighton, Mass.	372 Chelmsford Street
Murphy, Roger James, VI, N. Uxbridge, Mass.	31 Waverly Avenue
Murphy, Stuart Tower, VI, Tewksbury, Mass.	————
Newell, Kenneth Bernard, VI, Troy, N. Y.	27 Windsor Street
Nickerson, Earl James, V, Chelmsford, Mass.	————
Noonan, Joseph Donald, IV, Lowell, Mass.	35 Forest Street
Panto, Joseph Salvator, IV, Lawrence, Mass.	64 Mt. Hope Street
Patrick, Kit Carson, VI, Andover, Mass.	793 Merrimack Street
Pelliccione, Gregory Joseph, IV, Lawrence, Mass.	————
Peters, Margaret Jean, IV, Lowell, Mass.	163 Fort Hill Avenue
Pihl, Donald Greenwood, VI, Lowell, Mass.	11 Stromquist Avenue
Pofcher, Wilmer, III, Lowell, Mass.	376 Westford Street
Polak, Frank Walter, IV, Lowell, Mass.	552 East Merrimack Street
Quinn, Raymond John, IV, Lowell, Mass.	314 Wentworth Avenue
Reilly, Frank Thomas, I, Maplewood, N. J.	15 Douglas Road
Roberts, Richard S., VI, Brooklyn, N. Y.	77 Livingston Avenue
Robson, Daniel Riggs, III, Southbridge, Mass.	31 Waverly Avenue
Rosenkrantz, Stanley, I, Pottsville, Pa.	77 Livingston Avenue
Rostler, Seymour Stone, VI, Lowell, Mass.	31 Holden Street
Rutledge, Robert, Jr., VI, Lowell, Mass.	Andover Street
Ryan, Laurence Francis, Jr., VI, Garney's Point, N. J.	21 Dunbar Avenue
Salomon, Jay Stuart, VI, Brooklyn, N. Y.	39 Dover Street
Schlaginhaufen, Eric Alan, IV, North Bergen, N. J.	143 Upham Street
Seigel, Hersch David, II, Brookline, Mass.	37 Varney Street
Shapley, Harvey David, VI, Great Neck, N. Y.	77 Livingston Avenue
Shaughnessy, Robert Kenton, IV, Lowell, Mass.	18 Puffer Street
Sherburne, Edwin Collier, IV, Tyngsboro, Mass.	————
Sheroff, Melvin S., VI, Dorchester, Mass.	152 Wentworth Avenue
Silver, Bernard, III, Worcester, Mass.	25 Princeton Boulevard
Skrekas, Helen, IV, Dracut, Mass.	————
Smith, Donald Bishop, II, Maynard, Mass.	31 Waverly Avenue
Socransky, Morris Harvey, II, Mount Royal, Quebec	272 Merrimack Street
Solov, Leonard, II, Newton Center, Mass.	287 Stevens Street
Sousa, Theresa Mary, IV, Lowell, Mass.	38 Gershom Avenue
Splaine, Frank Edward, Jr., II, Rochester, N. H.	5 White Street
Stein, Alfred Eugene, VI, New Haven, Conn.	77 Livingston Avenue
Sternlieb, Herschel, V, Brighton, Mass.	320 Wilder Street
Stuart, Henry Bond, II, Whitinsville, Mass.	11 White Street
Sumers, Robert Warren, IV, San Diego, Calif.	106 Durant Street
Swiatek, Henry John, IV, Methuen, Mass.	————
Swrmelakis, Emmanuel John, II, Ayer, Mass.	37 Varney Street
Sybiak, Stanley, IV, Lowell, Mass.	57 Rock Street
Terris, John Henry, Jr., IV, No. Billerica, Mass.	————
Teta, Walter Michael, III, Brooklyn, N. Y.	299 Princeton Boulevard
Traversy, Adolphe Arthur, IV, Lowell, Mass.	124 Lilley Avenue

Home Address	*Lowell Address*
Trilling, Theodore R., Jr., II, Woodmere, N. Y.	287 Stevens Street
Tully, Donald Bernard, IV, Lowell, Mass.	249 Third Street
Tully, Francis Paul, IV, Lowell, Mass.	24 Light Avenue
Tully, Paul Raymond, IV, Lowell, Mass.	249 Third Street
Tung, Cheng-Yu, I, Shanghai, China	53 Nesmith Street
Vitkouskos, Albert Joseph, II, Haverhill, Mass.	———
Wang, James Paul, VI, Shanghai, China	30 White Street
Whitney, Kenneth, II, Pittsfield, Mass.	37 Varney Street
Whitworth, James Webster, IV, Chelmsford, Mass.	———
Wiener, Donald, IV, New Britain, Conn.	91 Methuen Street
Wilkinson, John Stewart, VI, No. Andover, Mass.	———
Wood, Samuel Anthony, IV, North Adams, Mass.	18 Fourth Street
Wolf, Melvin Lawrence, VI, Troy, N. Y.	77 Livingston Avenue

DIPLOMA STUDENTS

Class of 1948

Bates, William Charles, II, Neepawa, Can.	48 Harvard Street
Burns, Robert William, II, Whitefield, N. H.	19 Waverly Street
Dinan, Robert Joseph, II, Nashua, N. H.	———
Fanning, Leo Francis, II, Moosup, Conn.	298 Riverside Street
Fieldsend, George Tom, II, Hudson, Mass.	31 Waverly Avenue
Jones, Newton Browder, II, Sweetwater, Tenn.	Pleasant Street, Tewksbury
Jones, Richard Bradley, II, Hingham, Mass.	406 Pawtucket Street
Kent, Ferrell George, I, Melrose, Mass.	———
McCord, Douglas Duncan, III, Outremont, Que.	426 Andover Street
Mathieu, Robert Charles, II, Woonsocket, R. I.	406 Pawtucket Street
Mendrala, Edward John, II, Thompsonville, Conn.	305 Nesmith Street
Merrill, Richard Douglas, I, Chelmsford, Mass.	———
Murray, Ardelle May, III, Lowell, Mass.	1535 Middlesex Street
Poblocki, Raymond Robert, II, Webster, Mass.	406 Pawtucket Street
Rotham, Alvin, II, Brooklyn, N. Y.	52 Princeton Boulevard
Sweeney, Dennis John, II, Brockton, Mass.	272 Merrimack Street
Vallincour, Dorothy Jeannette, III, Lowell, Mass.	59 Foster Street
Whitehead, Charles Andrew, I, Dover, N. J.	31 Waverly Avenue
Whittier, Nathaniel True, III, Milton, Mass.	228 Varnum Avenue

SPECIALS

Barnes, Parker Loring, II, Plymouth, Mass.	227 Nesmith Street
Cohen, Alvin Sumner, IV, Brighton, Mass.	217 Jackson Street
Dickey, Harry Stanley, Jr., II, Baltimore, Md.	Central Square, Chelmsford
Hilditch, Norman, II, New Bedford, Mass.	———
Johnson, James William, VI, Tyngsboro, Mass.	———
Kisielewski, Joseph Louis, III, Webster, Mass.	272 Merrimack Street
Reimer, Morton Sterling, VI, North Adams, Mass.	406 Pawtucket Street
Simon, Stanley Rissman, VI, Chicago, Illinois	77 Livingston Avenue
Sullivan, John Francis, II, Belmont, Mass.	406 Pawtucket Street
Tenney, Ashton Melville, Jr., VI, Rye, N. Y.	48 Blodgett Park, No. Chelmsford
Teres, Howard Fred, V, Lowell, Mass.	245 Pine Street
Wornom, Lawrence Dale, VI, Chandler, Okla.	6 Beach Street, No. Chelmsford
Yarborough, William Hugh, VI, Bangs, Texas	73 Nesmith Street

SERIES 52. NO. 1.
CURRICULUM BULLETIN

August, 1948

LOWELL
EVENING TEXTILE SCHOOL

LOWELL, MASS.

1948-1949

Entered August 26, 1902, at Lowell, Mass., as second-class matter
under act of Congress of July 16, 1894

Textile and Colonial Avenue

A DEPARTMENT OF
LOWELL TEXTILE INSTITUTE

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TRUSTEES
OF THE LOWELL TEXTILE INSTITUTE

CALENDAR—1948

September 30, Thursday	Registration
October 5, Tuesday	Registration
October 11, Monday	Opening of Evening School
October 12, Tuesday	Columbus Day—Holiday
November 11, Thursday	Armistice Day—Holiday
November 24 and 25 Wednesday and Thursday	Thanksgiving Recess
December 20, Monday	Christmas Recess begins

1949

January 3, Monday	Classes resume
February 22, Tuesday	Washington's Birthday—Holiday
March 10, Thursday	Evening classes end

GENERAL INFORMATION

Entrance Requirements

Entrance requirements vary with the course or subject selected. For subjects taken toward a certificate, the requirement, in general, is graduation from grammar school or presentation of equivalent education. For those students desiring to obtain a diploma from the Lowell Evening Textile School, the requirement is graduation from a recognized high school or presentation of equivalent study or achievement.

Evidence of equivalent education, in place of grammar or high school graduation may be given by taking an examination, usually on registration evenings, or by presenting records of various courses taken elsewhere. Those who are not high school graduates but wish to work toward a diploma may satisfy the requirement by taking evening courses at the Textile School, consisting usually of Mathematics, English, Physics and Chemistry.

Registration

Students must register by filling out the necessary forms and paying fees, before attending classes. Registration is held on the dates indicated in the calendar above or on the opening nights of the various classes. Much time will be saved by registering in advance.

Sessions

Classes are held on Monday, Tuesday, Wednesday and Thursday evenings each week, usually from 7 to 9 P.M., although other hours are sometimes required in particular subjects. The subjects offered require from one evening per week to three evenings per week. (See subject schedules).

The scheduled nights for the various subjects in the following pages are tentative and may be altered in a few cases.

Fees and Deposits

Tuition for all evening courses is free to residents of Lowell, provided a certificate of residence is filed with the school office. Such certificates may be obtained from the Election Commission, City Hall, Lowell.

To non-residents the tuition fees are as follows:

One evening per week courses	$ 5.
Two evenings per week courses	$10.
Three evenings per week courses	$15.

Students electing any chemistry course must make a laboratory deposit of $10. Those electing Machine Shop Practice must make a laboratory deposit of $5. This is to cover supplies and breakage and any unexpended balance at the end of the year will be returned to the student. These laboratory deposit provisions apply to both residents and non-residents of Lowell.

All fees and deposits are payable in advance.

Veterans

All Lowell Evening Textile School courses are approved for study under the G. I. Bill of Rights. Veterans should secure a certificate of eligibility from the Veterans' Administration before registering. Books and supplies can not be obtained without it. A letter from the Veterans' Administration showing application for a certificate has been made will be accepted for temporary admission to classes but must be followed by a certificate of eligibility or tuition charges will be made.

Books and Supplies

Students must provide their own books, paper, drawing materials, etc., and pay for any breakage or damage of school equipment that they may cause.

Student supplies will be sold by the school cooperative store each evening school night from 6.45 to 8.15 P.M.

Diplomas and Certificates

Students satisfactorily completing individual courses, ranging in length from one to three years, will be awarded a certificate. (See listing of courses on following pages).

The diploma of the Lowell Evening Textile School will be awarded to students completing a prescribed group of courses, requiring, in general, three nights per week for five or six years. At present diploma courses are being offered in Analytical Chemistry (six years), Textile Chemistry and Dyeing (five years), Textile Chemistry and Testing (five years), Cotton Manufacturing (six years), Woolen Manufacturing (five years) and Worsted Manufacturing (six years).

The diploma courses were initiated in 1947 and, as yet, their content is tentative and subject to change. The Institute expressly reserves the right to alter or change them in scope and content as it deems advisable. In general, however, they should not differ materially from the programs shown.

Size of Classes

No first year course will be given unless at least 10 men register for it and in a few instances, more than that number. Advanced courses will usually, but not necessarily, be given, regardless of number.

COTTON DEPARTMENT

Staff

Prof. Gilbert R. Merrill, B.T.E., in charge of department
Asst. Prof. Nathaniel E. Jones
Mr. John A. Goodwin, B.T.E.
Mr. Clarence J. Pope, B.S.

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Cotton Yarns	101-A	X		X		None
Cotton Yarns	101-B		X		X	101-A
Cotton Yarns	101-C	X		X		101-B
Knitting	113		X		X	None

Description of the Above Courses

101-A *Cotton Yarns.* First year of cotton yarn manufacture. Topics covered include: properties and characteristics of raw cotton, cultivating, ginning and marketing of raw cotton, mixing, opening and picking, and carding. Lecture and laboratory.

101-B *Cotton Yarns.* Second year of cotton yarn manufacture. Topics covered include: combing, drawing, regular and long draft roving. Lecture and laboratory.

101-C *Cotton Yarns.* Third year of cotton yarn manufacture. Topics covered include: spinning, spooling, winding and twisting. Lecture and laboratory.

113 *Knitting.* A general course in the manufacture of knitted fabrics and garments. It includes yarns and yarn sizing.

Certificates

The certificate of the school will be awarded for completion of the three-year course in cotton yarns, 101-A, 101-B and 101-C. A certificate will also be awarded for the completion of 113.

Diploma in Cotton Manufacturing

A diploma in cotton manufacturing will be awarded to those completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work towards an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to schedule in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

Courses required for a diploma include three years of cotton yarn manufacture, mechanism, two years of cotton design, two years of warp preparation and weaving, cotton dyeing and finishing, textile testing, marketing and knitting.

While the work load in individual years will vary, a student could expect to complete this program in six years if he attends an average of three nights per week.

This group of courses provides a background in all the basic processes in a cotton mill and is designed for the student who wishes to prepare himself for higher supervisory and executive positions.

WOOLEN AND WORSTED DEPARTMENT

Staff

Prof. Russell L. Brown, B.T.E., M.S., in charge of department
Asst. Prof. John C. Lowe, B.T.E., M.S.
Asst. Prof. James H. Kennedy, Jr., B.T.E., M.S.
Mr. Henry L. Pero, B.T.E.
Mr. Harold R. Anderson, B.T.E.

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Fiber Preparation	202	X				None
Woolen Yarns	203		X			601
Top Making	204		X			601
Bradford Yarns	205	X				601
French Yarns	206	X	X			601
Textile Mechanism & Calculations	601				X	None

Description of the Above Courses

202 *Fiber Preparation.* Types of sheep and wool. Wool grading, sorting, scouring, and carbonizing. Reworked fiber preparation from rags to product. Synthetic fiber staple as rayons, nylon, proteins and plastics. Lecture and laboratory demonstration.

203 *Woolen Yarns.* Fiber blending, oiling, picking, carding, spinning and twisting into woolen type yarns. Lecture and laboratory demonstration.

204 *Top Making.* Worsted carding, backwashing, gilling, Noble and French combing. Specification and analysis for wool and synthetic staple top. Lecture and laboratory demonstration.

205 *Bradford Yarns.* Worsted drawing, spinning and twisting on English system machinery. Lecture and laboratory demonstration.

206 *French Yarns.* Worsted drawing, spinning and twisting on French system machinery. Lecture and laboratory demonstration.

601 *Textile Mechanism and Calculation.* A short course covering the necessary mechanism, physics and mathematics required for an understanding of textile machines. In mechanism it covers pulleys, cones, gears, levers, cranks, etc.; in physics it takes up latent heat, vaporization, relative humidity, etc.; in mathematics the topics include constants, square roots, ratio, proportion, formulas, slide rule, etc. It is designed to be taken simultaneously with the courses for which it is a prerequisite.

Certificates

The certificate of the school will be awarded for the following group of courses:

Woolen Yarn Certificate— For completion of courses 601, 202, 203. Normally requires one year of three evenings per week.

Top Making Certificate— For completion of courses 601, 202, 204. Normally requires one year of three evenings per week.

Bradford Worsted Certificate—For completion of courses 601, 202, 204, 205. Normally requires two years of two evenings per week.

French Worsted Certificate— For completion of courses 601, 202, 204, 206. Normally requires two years, one of three evenings per week and one of two evenings.

Diplomas

A diploma in woolen or worsted manufacture will be awarded to students completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work toward an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to take in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

For a diploma in woolen manufacture the student must complete the woolen yarn certificate course and two years of woolen design, two years of woolen weaving, wool dyeing and finishing, textile testing, marketing and knitting. Normally a student could expect to complete this program in five years, if he attends an average of three evenings per week.

For a diploma in worsted manufacture the student must complete both Bradford and French worsted yarns and take courses in worsted design, weaving, dyeing and finishing, textile testing and marketing. Normally a student could complete this program in six years if he attends an average of three evenings per week.

These courses will give the necessary background for the operation of a woolen or worsted mill and are designed for the student who wishes to prepare himself for the higher supervisory and executive positions.

TEXTILE DESIGN AND WEAVING DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Asst. Prof. Martin J. Hoellrich
Asst. Prof. Russell M. Fox
Asst. Prof. John L. Merrill, B.T.E.
Asst. Prof. Edward L. Golec
Mr. Heman Hunter
Mrs. Lucy R. Weinbeck
Mr. Jordan Levin

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur	PREREQUISITE
Weave Formations (First 10 weeks only)	301-A			X		None
Yarn Calculations (First 10 weeks only)	301-B	X				None
Cotton Design (Second 10 weeks only)	327	X		X		301-A, 301-B
Cotton Design*	328		X		X	327
Cotton Design†	311-A		X		X	301-A, 301-B
Cotton Design†	311-B		X		X	311-A
Woolen Design (Second 10 weeks only)	329	X		X		301-A, 301-B
Woolen & Worsted Design*	330	X		X		329
Woolen & Worsted Design†	312-A	X		X		301-A, 301-B
Woolen & Worsted Design†	312-B	X		X		312-A
Synthetic Design (First 10 weeks only)	325-A		X		X	327
Synthetic Design*	325-B		X		X	325-A
Fabric Identification (Second 10 weeks only)	331		X		X	301-A
Power Weaving‡ (First 10 weeks only)	332		X		X	None
Power Weaving‡	333	X		X		332
Loom Fixing‡	324		X		X	333

* Not offered in 1948-1949.
† For those who started their program prior to this year and desire to complete their certificate work under the old plan.
‡ Loom Fixing may be taken without 333 provided sufficient work has been done by the student in industrial weaving. 333 may be taken without 332 under similar conditions.

Description of the Above Courses

301-A *Weave Formations.* This subject covers weaves of all types from the plain weave through fancy and figured weaves. Harness draft and chain are worked out for each weave.

301-B *Yarn Calculations.* Yarn counts for all systems, including ply and fancy yarns, are covered.

327 *Cotton Design.* Cotton cloth analysis and design are studied, beginning with plain fabrics and leading into the more fancy dobbies.

328 *Cotton Design.* The design of more elaborate cotton fabrics is taken up, such as filling backed, warp backed, ply, velvet, leno, etc.

311-A *Cotton Design.* Cotton cloth analysis and design are studied, beginning with plain fabrics and leading into the more fancy dobbies. More class room practice is provided than in 327.

311-B *Cotton Design.* The design of more elabovate cotton fabrics is studied, such as filling and warp backed fabrics, ply, velvet, leno, etc. Similar to course 328.

329 *Woolen Design.* Cloth analysis and design covering blankets, bath robing, filling reversibles, extra warp and filling backs, figured effects, double cloths and plaid back.

330 *Woolen and Worsted Design.* This subject includes the more complicated fabrics some of which are chinchilla, melton, kersey as well as suitings. Costs for woolen and worsted fabrics are also covered.

312-A *Woolen Design.* Similar to 329 but more time is devoted to work in class.

312-B *Woolen and Worsted Design.* Similar to course 330, for those working under the old plan.

325-A *Synthetic Design.* Cloth analysis and design of synthetic fabrics, including both filament and spun yarns.

325-B *Synthetic Design.* A continuation of 325-A covering the more fancy and complicated types of synthetics.

331 *Fabric Identification.* An elementary course in fabrics for those not specializing in industrial work, such as retail clerks, home economics students, etc.

332 *Power Weaving.* Warp preparation in all systems is covered as well as the Draper and Stafford automatic looms. Lecture and laboratory.

333 *Power Weaving.* More complicated looms are studied including dobby and Crompton & Knowles looms. Primarily woolen and worsted weaving. Lecture and laboratory.

324 *Loom Fixing.* The timing of all different motions in the loom and remedies for improper settings are covered. Box and harness chain planning and building are included. Lecture and laboratory.

Certificates

The cotton design certificate will be awarded for completion of 301-A, 301-B' 327, and 328 under the new plan or 301, 311-A and 311-B under the previous schedule.

The woolen and worsted design certificate will be awarded for completion of 301-A, 301-B, 329 and 330 under the new plan or 301, 312-A and 312-B under the previous schedule.

The synthetic design certificate will be awarded for the completion of 301-A, 301-B, 327, 325-A and 325-B.

The loom fixing certificate will be awarded for the completion of 324.

The weaving certificate will be awarded for the completion of 333.

Diplomas

No diploma in design and weaving is offered as yet, but plans are under way for such. When and if a diploma is offered, the above certificates will count towards it.

ART DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department

Elbert G. Bowring
Helen Chace
Antoinette Nault
Elenor Palmer
Mary S. Kiernan
Arlene Redmond
E. Stuart Dickison

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Freehand Drawing	313-A					
Section I		X		X		None
Section II			X		X	None
Pastel Drawing	334		X		X	313-A
Life Drawing	313-B	X		X		313-A
Silk Screen Printing	326		X		X	None
Show Card Design	314-A	X		X		None
Costume Design	335		X		X	None

Description of the Above Courses

313-A *Freehand Drawing.* Drawing in charcoal from casts and group arrangements of still life. Both sections cover the same material.

334 *Pastel Drawing.* Drawing in pastel from still life group arrangements.

313-B *Life Drawing.* Drawing from the live model in charcoal or in pastel. Individual and class instruction in anatomy.

326 *Silk Screen Printing.* This course covers the stencilling and printing on textiles and paper with the silk screen.

314-A *Show Card Design.* Pencil drawing of the alphabet and simple layouts of card signs executed in tempera paints.

335 *Costume Design.* How to alter the commercial garment pattern to suit the requirements of any figure.

Certificates

The three-year certificate in art will be awarded for the completion of 313-A plus any two of the subjects listed above.

CHEMISTRY DEPARTMENT

Staff

Prof. Elmer E. Fickett, B.S., in charge of department
Asst. Prof. William G. Chace, Ph.B., M.S.
Asst. Prof. Charles L. Daley, B.T.C.
Asst. Prof. Charles A. Everett, B.T.C.
Asst. Prof. Ronald E. Glegg, B.Sc., Ph.D.
Asst. Prof. Charles L. Howarth, B.T.C.
Asst. Prof. John H. Skinkle, S.B., M.S.
Mr. Ernest P. James, B.T.C.
Mr. Thomas F. Kelley, Jr., B.S.
Mr. Vasilis Lavrakas, B.S., M.S.
Mr. Walter J. Lisien, B.T.C.
Mr. Joseph B. Masaschi, B.T.C.
Mr. Ray E. MacAusland

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
General Chemistry	411-A		X	X	X	None
General Chemistry	411-B		X	X	X	411-A
Qualitative Analysis & Stoichiometry	411-C	X	X		X	411-B
Quantitative Analysis & Stoichiometry	413-A	X	X		X	411-C
Quantitative Analysis & Stoichiometry	413-B	X	X		X	413-A
Quantitative Analysis & Stoichiometry	413-C	X	X		X	413-B
Textile Chemistry & Dyeing	412-A	X	X		X	411-B
Textile Chemistry & Dyeing	412-B	X	X		X	412-A
Textile Chemistry & Dyeing	412-C	X	X		X	412-B
Dye Testing	416-A	X	X		X	411-B
Textile Testing & Microscopy	416-B	X		X	X	416-A
Textile Testing & Microscopy	416-C	X		X	X	416-B
Organic Chemistry	417			X		411-B
Chemistry of Leather	415		X		X	411-C
Technology of Leather	418		X		X	411-A

Description of the Above Courses

411-A *General Chemistry.* For those with no previous knowledge of chemistry. This course covers the basic principles of inorganic chemistry including the fundamental chemical laws; the preparation, properties, and uses of metals, non-metals and related compounds; and simple chemical calculations. Lectures and laboratory.

411-B *General Chemistry.* A course in elementary chemistry of college grade, open to those who have passed 411-A or a satisfactory course in high school chemistry. Emphasis is on the laws and theories of inorganic chemistry. Text—General Chemistry by Timin.

411-C *Qualitative Analysis and Stoichiometry.* A basic course in the systematic analysis of inorganic compounds, carried out by the student in the lab. Chemical calculations and the balancing of chemical equations are covered in the stoichiometry portion of the course.

413-A, 413-B, 413-C *Quantitative Analysis and Stoichiometry.* The first two years of this three-year course cover the underlying principles of gravimetric and volumetric analysis, with sufficient laboratory work to enable the student to become proficient in performing routine analysis. The third year consists in the

analysis of water, soap, oils, coal and other materials of interest to the textile chemist.

NOTE: The diploma course in quantitative analysis, listed above, consists of 8 hours per week including 6 lab and 2 lecture. A similar 3-year course of 5 hours of lab and 1 of lecture each week is still offered to those who enrolled prior to October, 1947. The latter carries a certificate only.

412-A, 412-B, 412-C *Textile Chemistry and Dyeing.* This course covers three years work of lectures and laboratory in the following topics: the action of chemical reagents on the natural and synthetic fibers, the preparation of the fibers for dyeing, the application of all classes of dyes to cotton, wool, silk, synthetic, and union materials.

416-A *Dye Testing.* This course covers the necessary principles of dyeing and concentrates on the testing of dyes for fastness to light, washing, perspiration, etc., by modern laboratory testing technique. Lecture and laboratory.

416-B, 416-C *Textile Testing and Microscopy.* A two-year course covering the fundamentals of textile testing whereby the various physical, chemical, and optical methods are integrated into a unified program. Some of the topics covered include: regain, yarn numbers, twist, bursting strength, tear resistance, strength and elongation, yarn and seam slippage resistance, abrasion testing, permeability, water repellent and water proofness, fiber mixtures, longitudinal and cross-sectional mounts of various fibers, and the operation of various optical instruments. Lecture and laboratory.

417 *Organic Chemistry.* A study of the important classes of carbon compounds and the fundamental theories of organic chemistry. Lecture only.

418 *Technology of Leather.* An elementary course covering the preparation of leather of various types and finishes. The chemistry and technology of various tannery processes are covered so as to be understandable to a student with a fair knowledge of chemistry. Lectures only

415 *Chemistry of Leather.* An intensive course on a college level in the chemistry of leather manufacture. The chemical reactions in each tannery process are covered as well as the chemistry of proteins, fats, and enzymes. Analytical methods are employed in the laboratory work. Lectures and laboratory.

Diplomas

A diploma in Analytical Chemistry will be awarded for the successful completion of courses 411-A, 411-B, 411-C, 413-A, 413-B, and 413-C. This normally takes six years of three evenings per week.

A diploma in Textile Chemistry and Dyeing will be awarded for the successful completion of courses 411-A, 411-B, 412-A, 412-B, 412-C and 417. This normally takes five years of three evenings per week.

A diploma in Physical and Chemical Textile Testing will be awarded for the successful completion of 411-A, 411-B, 416-A, 416-B, 416-C, and 417. This requires five years of three evenings per week.

Only high school graduates (or the equivalent) are eligible to enroll for diploma courses in chemistry. The work covers the same ground and is held up to the same standard as the corresponding day school courses and will be accepted for day school credit towards the B.S. degree of the Lowell Textile Institute.

Certificate

For those wishing only a general knowledge of chemical fundamentals, a certificate will be issued for the completion of General Chemistry 411-A and 411-B.

ENGLISH DEPARTMENT

Staff

Prof. Lester H. Cushing, A.B., Ed.M., in charge of department
Asst. Prof. James G. Dow, A.B.
Mr. Louis W. Stearns, B.S., M.A.

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
English composition	511-A	X				None
English composition	511-B				X	511-A
Appreciation of Literature	512		X			None

Description of the Above Courses

511-A *English Composition.* The fundamentals of composition including remedial English, grammar and rhetoric.

511-B *English Composition.* A course in how to write clearly and correctly. An intensive study is made of narration, description, exposition, argumentation and the art of letter writing.

512 *Appreciation of Literature.* A course for those wishing to enlarge their cultural background and study the principles of literary appreciation and criticism. Prose and poetry will be treated analytically with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative and the philosophical.

Certificates

The certificate of the school will be awarded for the successful completion of 511-A and 511-B.

BUSINESS AND INDUSTRIAL MANAGEMENT

Staff

Asst. Prof. Charles F. Edlund, S.B., Ed.M., in charge of department
Prof. Herman H. Brase, M.A., guest lecturer
Mr. Francis Maria, B.A.
Mr. Armand J. Sorbo
Mr. Richard W. Ivers, B.A.
Mr. Richard E. Kaknes, B.S.

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Industrial Psychology	513	X			X	None
Foremanship	653	X		X		None
Time Study Methods	654		X		X	None
Industrial Relations	655	X		X		None
Principles of Salesmanship	656		X		X	None
Principles of Advertising	657		X		X	None

Description of the Above Courses

513 *Industrial Psychology.* In this course the psychologist helps the student to apply to himself in industry the principles and facts of psychology. It recognizes the human element in production. Topics treated are employment principle, on the job training and growth, psychological factors in efficiency, safety, morale and getting the most out of your job. Lectures and discussions.

653 *Foremanship.* A course in foremanship principles and problems based on the Foremanship Management Conference Manuals of the National Foreman's Institute. It is designed to help men now acting as foremen in a more successful handling of their job and is conducted by the conference or seminar method, each man bringing in his own problems for analysis by the group. Some of the topics include understanding people, the foreman as a leader, eliminating irritations, training workers on the job, getting along with the man above, eliminating waste, wage incentives, cost factors the foreman can control, etc.

654 *Time Study Methods.* A course in the fundamental principles and techniques of methods engineering. Some of the topics covered include: employee psychology, job analysis, rate setting, timing, etc. In addition to lectures this course will include several actual field problems in industrial time setting.

655 *Industrial Relations.* A basic course in the underlying principles of harmonious relations between employer and employee. Some of the topics covered include: company policies and the foreman, employee morale, grievances, wages, training, collective bargaining, unions, government regulations, arbitration, etc.

656 *Principles of Salesmanship.* The fundamentals of salesmanship including the psychology of selling, building a selling talk, showmanship, elements of successful selling, wholesale and retail salesmanship, etc. Lectures plus student participation.

657 *Principles of Advertising.* The fundamentals of advertising including psychology, copy writing, layout, production, testing, campaigns, etc. Lectures and assignments.

Certificates

A certificate will be awarded for the completion of any one of the above six courses.

ENGINEERING DEPARTMENT

Staff

Prof. Herbert J. Ball, S.B., B.C.S., F.T..I, in charge of department
Asst. Prof. Harry C. Brown, S.B.
Asst. Prof. A. Edwin Wells, B.T.E., Ed.M.
Asst. Prof. Horton Brown, B.S.
Asst. Prof. Milton Hindle, B.T.E.
Mr. Paul D. Petterson
Mr. Elliot F. Humiston, S.B.
Mr. Henry E. Thomas, B.T.E.
Mr. Maurice E. Gelinas, S.B., A.M.
Mr. Robert M. Kennedy, B.T.E.
Mr. Isaac Chase, Jr., B.S.
Mr. Andrew A. Ouellette, Sc.B.
Mr. James W. Bell
Mr. Albert L. Carpentier, B.S.
Mr. Edward N. Sabbagh, B.S.

Mathematics and Engineering Sub·ects

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Mathematics	620-A	X		X		None
Mathematics	620-B		X		X	620-A
Mathematics	645	X		X		None
Physics	647		X		X	None
Mechanical Drawing	613-A	X		X		None
Mechanical Drawing	613-B		X		X	613-A
Mechanical Drawing	613-C		X		X	613-B
Architectural Drawing	613-D		X		X	613-A
Architectural Drawing	613-E		X		X	613-D
Blue Print Reading	638		X		X	None
Machine Shop Practice	614-A			X	X	None
Machine Shop Practice	614-B	X	X			614-A
Strength of Materials	621		X		X	None
Steam	622	X		X		None
Mechanism	630		X		X	None
Diesel Engines	632		X		X	None
Air Conditioning	634	X		X		None
Textile Testing	639	X		X		None
Statistical Quality Control	646		X		X	See description

Description of the Above Courses

620-A *Mathematics.* Algebra including addition, multiplication, subtraction, division, factoring and fractions.

620-B *Mathematics.* A continuation of 620-A. Some of the topics treated are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule, and some trigonometry.

645 *Mathematics.* An accelerated course in algebra for those satisfying the instructor as to their ability to pursue it. It covers algebra from the beginning to beyond quadratics.

647 *Physics.* An elementary course in physics on the high school level, designed primarily for those lacking sufficient high school credits to work towards a diploma. Lecture and demonstration.

613-A *Mechanical Drawing.* The fundamentals of drawing. Use of instruments, geometric construction, lettering, orthographic projection, auxiliary views, sectional views and dimensioning.

613-B *Mechanical Drawing.* Second year for those whose interest is primarily in machine drawing. Engineering sketching, screw threads and fasteners, intersections and developments of surfaces, pictorial drawing.

613-C *Mechanical Drawing.* Third year. Sheet metal drawing, detail and assembly drawing, blueprinting from pencil and ink originals. Computation of areas, volumes and weights.

613-D *Architectural Drawing.* A continuation of 613-A for those whose main interest is in architectural drawing. The course will revolve about the design of a small house and will include a plot plan, floor plans, elevations, sections and architectural details.

613-E *Architectural Drawing.* Third year. The set of house plans begun in 613-D will be completed with drawings of heating, plumbing and electrical systems in orthographic and isometric styles. Cost estimates and a perspective of the house will complete the course.

638 *Blue Print Reading.* A short course for those who wish to understand the principles of mechanical drawing such as projections, sections, dimensioning, etc., in order to read and understand blue prints.

614-A, 614-B *Machine Shop Practice.* A two-year course in metal working, including bench work, lathes, grinders, planers, shapers, presses, milling machines, care of tools, tool grinding, heat treatment, forging, use of special tools, etc.

621 *Strength of Materials.* A basic course in strength of materials covering such topics as tension, compression, shear, cast iron, wrought iron, steel, timber, design of bolts, tie rods, columns, boiler shells, riveted joints, etc., beam theory, torsional stresses, shafts, etc.

622 *Steam.* Heat generation, transmission, and utilization. Topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, testing, etc. Lectures and assignments.

630 *Mechanism.* A study of the principles used in the transmission of force and motion through machines and mechanical devices. Topics covered are mechanics, accelerated motion, moments of force, pulleys, belting, gears, cams, etc.

632 *Diesel Engines.* An elementary study of diesel engines, their operation, and maintenance. Topics covered include types of diesels, fuel oils, fuel injection systems, combustion, cooling systems, application, maintenance, etc. Lectures and assignments.

634 *Air Conditioning.* A course in the principles of air conditioning covering the fundamental laws, physical properties of the atmosphere, measuring instruments, heating, cooling, humidification and dehumidification systems, air filtration, refrigeration, etc. Lectures and assignments.

639 *Textile Testing.* The determination of the physical properties of textiles and the evaluation of test data. The topics covered include textile fibers and their properties, testing machines, breaking strength, elongation, fabric structure, bursting strength, crimp, twist, regain, etc. Lectures and laboratory.

646 *Statistical Quality Control.* A course for those concerned with statistical analysis in business, especially those charged with maintaining uniformity of product in manufacture. Better-than-average background is necessary to take this course, two years of college or its equivalent being required.

Topics studied include: frequency distribution, central tendency, reliability, significance, probability, simple average and range control charts, tolerance, sampling and cost comparison problems.

Certificates

The certificate of the school is awarded for the completion of the following courses or groups of courses described above: 620-A and 620-B; 645; 647; 613-A, 613-B, 613-C; 613-A, 613-D, 613-E; 638; 614-A and 614-B; 621; 622; 630; 632; 634; 639; and 646.

ELECTRICITY

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Electrical Circuits	644	X		X		None
D. C. Machinery	636-A		X		X	644
A. C. Machinery	636-B		X		X	644
Fundamentals of Electronics	640		X		X	644
Industrial Electronics	641			X	X	640
Principles of Radio	642	X		X		640
Cathode Ray Oscilloscope	643		X		X	640

Description of the Above Courses

644 *Electrical Circuits.* A basic course in direct and alternating current circuits. Topics include: Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance, etc. Lecture and laboratory.

636-A *D. C. Machinery.* The theory and operation of generators, motors, power plant switchboards, etc. Industrial application of D. C. machinery, parallel operation, etc. Laboratory work covers methods of operating and testing D. C. equipment.

636-B *A. C. Machinery.* Topics include application of instruments to A. C. circuits, alternators, transformers, power plant switchboards, induction motors, synchronous motors, single phase, polyphase (delta and three phase, four wire systems), etc. Laboratory work covers operation and testing of equipment.

640 *The Fundamentals of Electronics.* Topics include vacuum tube theory, vacuum tube applications including rectifiers, power supplies, amplifiers, classes of amplifiers, voltage gain and power amplifiers, electronic instruments, etc. Lecture and laboratory.

641 *Industrial Electronics.* The theory and operating characteristics of gas and vacuum tubes, photo-electric cells, and the thyratron. Topics covered include amplifiers, electronic relays and timers, thyratron applications, phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Lecture and laboratory.

642 *Principles of Radio.* Audio systems, microphones, loud speakers, radio wave propagation, antennas, transmission lines, amplitude and frequency modulation, radio transmitters, modulators, detectors, receivers, tracking and alignment, servicing instruments, etc. Lecture and laboratory.

643 *Cathode Ray Oscilloscope.* The theory of the cathode ray tube including elementary electron optics, block diagram, electrostatic and magnetic deflection. Sweep circuits, sawtooth oscillators, wobbulators, power supplies, deflection plate amplifiers, and oscilloscope circuits. Laboratory application of the oscillloscope and auxiliary equipment in wave form study, frequency measurement, response curves, distortion, modulation, etc.

Certificates

A certificate in Electrical Machinery will be awarded for the successful completion of 644, 636-A and 636-B.

A certificate in Industrial Electronics will be awarded for the successful completion of 644, 640 and 641.

A certificate in Radio will be awarded for the successful completion of 644, 640 and 642.

A certificate in the Cathode Ray Oscilloscope will be awarded for the successful completion of 644, 640 and 643.

FINISHING DEPARTMENT

Staff

Prof. Cornelius L. Glen, in charge of department
Asst. Prof. Winford S. Nowell, B.M.E.

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Woolen & Worsted Finishing	710	X		X		None
Cotton Finishing*	711					None

* Not offered in 1948-1949

Description of Above Courses

710 The finishing of both woolen and worsted cloths. Some of the topics covered are burling, mending, fulling, washing, speck dyeing, carbonizing, gigging, napping, steaming, brushing, shearing and pressing. Lectures and some laboratory demonstration.

711 The finishing of cotton and synthetic fabrics. Some of the topics covered are inspecting, trimming, shearing, singeing, washing, napping, mangles, straching, dryers, stretchers, callenders, folding and marking. Lectures and some laboratory demonstration.

Certificates

The certificate of the school will be awarded for the successful completion of either of the two above courses.

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RECENT RESEARCH ON THE MECHANICAL BEHAVIOR OF TEXTILES

by

Chapin A. Harris*

I. Introduction

The great number of papers that have appeared in recent years on the properties of fibers and textiles has made it difficult to keep abreast of the advances. It is apropos to briefly review the developments and reflect on their significance. It has not been attempted in this report to consider every phase of these recent advancements on the subject; but an effort has been made to give an over-all picture of the developments and several references to specific works.

The properties of textiles are of immediate interest to the manufacturer and the user. However, the characteristics of textiles depend on the basic fiber properties and the translation and interaction of these properties through the multitude of geometrical factors that contribute to the structure of the textile. Some of the fundamental fiber properties are extremely complex. The problems of following these basic but complicated properties through the intricate structures of textiles are at the outset manifold. Therefore, it is not surprising that a large portion of the recent work has been confined to either the fibers and simple yarns or the textile itself with only relatively little information published on specific relations between fiber properties and textile characteristics.

II. Historical Review

Except for a few investigators, early work on fibers and textiles was confined to simple strength, elongation, tear, abrasion tests, and the like, some of which were quite complex but were usually not considered as such. Gradually, an engineering viewpoint was adopted as it became obvious that fibers were complex in their behaviors as well as their structures and that in building up the textiles from the fibers other complicating structural components had been added.

F. T. Pierce in England in the late 20's did much to direct textile research into more scientific channels. He pointed out that time was an important factor in textile testing.[1]†

Leaderman in his classical work[2] reviewed much of the very early work on the time effect in fiber testing. It is interesting to note that Weber investigated the immediate and delayed elastic extension of raw silk back in 1835.[3] F. Kohlrausch and R. Kohlrausch (father and son) conducted studies on the delayed elasticity of silk and glass filaments[4 5 6]. These very early workers were not concerned with the performance or properties of textiles but in the fundamental properties of materials.

Leaderman[2] and other workers such as Press and Mark[7] brought the investigation of the delayed elasticity of fibrous high polymers to its present day activity. Such terms as instantaneous elasticity, primary creep, secondary creep, visco-elastic behavior of high polymers and superposition principle are a part of the new language of the textile research worker.

Harold deWitt Smith[8] instilled into textile research, if it had never been there before, the philosophy of approaching the work with an engineering viewpoint. The difference between the ability of various fibers to absorb energy or work and the performance of these fibers in textiles was made clear. The shape of the fiber as a geometry or "form factor" in the behavior of a textile was pointed out along with numerous other engineering concepts. It should be mentioned in passing that Pierce[9] and Womersley [9a] were concerned with the geometry of textiles and its effect on performance back in the 30's.

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*—Professor, Lowell Textile Institute.

†—Superscript numbers refer to references listed at end of paper.

III. Visco-elastic Behavior of Fibers

Leaderman[2] reviewed the work on the types of creep and creep recovery and the development of theories and models to explain these visco-elastic behaviors of filamentous and other high polymeric materials. He also described his own work on several textile fibers and compared the results with the theories. The summary of Leaderman's work which follows, briefly presents his definitions, interpretations and conclusions.

When textile fibers are subjected to a dead tensile load for the first time, there is an immediate elongation followed by a delayed elongation that proceeds at a diminishing rate. If the load is removed after a period of time, there is an instantaneous recovery towards the original length by an amount equal to the original instantaneous elongation. This immediate recovery is then followed by a delayed recovery which again proceeds at a diminishing rate until there is no further change. The fiber, however, will not shrink to its original length. Upon reloading the fiber and then again unloading, it will exhibit a similar behavior except that it will return to the length just before the second loading. There are, of course, a number of factors which determine whether a fiber will act just as described above (such as amount of load, time of loading, etc.) but in general this gives a qualitative picture of the behavior of fibers under load. This type of phenomenon has been referred to as "visco-elastic" in nature. In other words, a fiber acts somewhat like a viscous liquid since it flows under deforming stresses. Furthermore, it is also elastic, since it tends to return to its original dimensions when the stress is removed even though it may take a long time for this to occur.

To define the various actions:—

(1) Instantaneous deformation—the truly elastic elongation which takes place immediately upon application of load. Because it is truly elastic, it is of course instantaneously recoverable (obeys Hooke's law).

(2) Secondary creep—the non-recoverable extension produced by the first (or possibly first few) deformations. Secondary creep is definitely non-recoverable viscous flow of some sort within the molecular structure of the fiber.

(3) Primary creep—the delayed deformation which takes place over a period of time and is completely recoverable over a period of time after removal of load.

(4) Mechanical conditioning—the removal of secondary creep from a fiber by sufficient loadings of the required magnitude so that no further non-recoverable deformation will occur upon further loading of no greater magnitude than the conditioning load.

It is obvious before going further, that there are a multitude of factors that complicate this visco-elastic behavior of fibers in the usual testing procedures and in textile behavior. The rate and nature of loading, the atmospheric conditions, and the geometry of the textile all contribute complex variables.

Leaderman covered the theories of creep advanced by Weber[2], Kohlrausch[4], Boltzmann[10 11 12] and others. Boltzmann proposed the theory that the entire loading history of a material which exhibits primary creep determines the deformation at any time. From this and Kohlrausch's work came the Superposition Principle, which, in effect, states that any residual deformation observed in a fiber after a complex loading history is the simple sum of the residual deformations caused by each of the loads applied. The Superposition Principle was developed only for those materials from which the secondary creep had been removed.

Mathematical equations were derived to account for the deformation existing in a material after a previous loading history. It is not the intent nor is it within the scope of this paper to present this work in detail. Numerous experiments by Kobeko[13], Hetenyi[14], Boltzmann, Kohlrausch, Hopkinson[15] and others gave strong indication that the Superposition Principle was sound. Many of the tests were made on materials other than textile fibers; and most of the newer manufactured fibers were unknown at the time. Leaderman found that for some of the newer fibers such as nylon, certain modifications of the superposition principle were necessary.

The next step in the development of the studies on the visco-elastic properties of fibers and other high polymers was the use of simple mechanical models. The action of these models under stress was intended to represent the behavior of fibers under stress. The word "visco-elastic," as mentioned before, connotes both a viscous reaction to applied stress as well as an elastic reaction. Mechanically, viscous flow might be represented by a piston moving in a thick liquid. Such a system is often referred to as a "dashpot." A force applied to the end of the dashpot would not immediately cause a movement of the piston. However, gradually the piston would start to move at an increasing rate until a maximum velocity is reached depending upon the force applied and the viscosity of the liquid. Our simplest mechanical picture of an elastic element is the spring. Immediately upon application of a load to the spring, a deformation would take place in proportion to the force and the extensibility of the spring. No further change in the length of the spring would occur thereafter until the load is changed. With combinations of springs and dashpots in series and in parallel, the instantaneous elastic deformations, the secondary and the primary creep, and the creep recovery, can be at least qualitatively explained. Therefore, numerous spring and dashpot mechanical models have been presented to illustrate the internal structure of fibers in relation to their visco-elastic behavior. According to Leaderman, Poynting and Thompson[16] were the first to propose this type of mechanical model in 1902. Even electrical models made up of condensers (representing the viscous effect) and resistances (representing the elastic effect) have been proposed. As each new unexplained factor in the visco-elastic behavior of fibers came to light a new arrangement of springs and dashpots was proposed. Considerations of flow and spring action of the molecular structure of fibers followed the use of mechanical models.

Without doubt, the mechanical models have done much to clarify our picture of fiber behavior; but it is certain that none of them explain everything. As more investigators, such as Press[17, 18], Dillon and co-workers[18, 19], Eyring, Halsey and co-workers[20], Burleigh and Wakeham[21], and others studied both experimentally and theoretically the phenomena of creep or stress relaxation in yarns and fibers, it became more clear that the spring and dashpot models did not completely explain these complex behaviors. Recently Burte and Halsey[22] advanced a new theory which is not based on spring and dashpot models, but is concerned with energy states and changing populations during the extension of fibers. The theoretical presentation involves the change of configuration of the fiber molecules during extension from one form to another and considers the changes in energy that might take place, the breaking and reforming of secondary bonds (and their energies) and the energy barriers that exist between the initial and final configurations. Burte, Halsey and Dillon[23] have extended this new theory of energy barriers for flow, particularly in explaining the mechanical behavior of wool.

IV. Resilience of Textiles

A discussion of the visco-elastic properties of fibers, particularly when presented as sketchily as in this paper, makes one wonder where this sort of thing fits into the practical aspects of textiles. Although these complex phenomena enter into all aspects of the mechanical behavior of textiles, the resilience of textiles will perhaps serve as an adequate example.

Smith[8] pointed out the need for more study on the resilience of fibers from the standpoint of learning more about the performance of textiles in use He mentioned Loasby's work[24] on the degree of resilience of various fibers through a range of extensions and emphasized that because of the visco-elastic behavior of fibers there is danger in extrapolating laboratory test data to predictions of the performance of textiles. Smith defined resilience as the recoverable work per unit volume of a material which has been stretched. Degree of resilience (sometimes referred to as recovery power) is defined as the ratio of recoverable work to the work necessary to cause the elongation.

Ray[25] gave some comparisons of the degree of resilience of several fibers as affected by the elongation imposed upon them. Wool and nylon exhibited interesting relationships within the elongation limits suggested by Ray to represent

those that would be found under conditions of use. Wool recovered over 90% of the absorbed work throughout the range of 0 to 2% elongation. Nylon recovered only 70%, but like wool this was over the entire range. Other fibers recovered more of the work absorbed than nylon at very low extensions; but they recovered much less work than nylon at greater elongations.

Hamburger[26] suggested the term "elastic performance" in place of "resilience" since extensibility and "softness" properties are not necessary adjuncts to elastic performance and therefore should be treated as separate performance behaviors. He pointed out that the time factor of loading which involves primary and secondary creep as well as the immediate elastic deformation have not been considered in earlier studies on resilience. Since secondary creep is removed after a few loadings, it contributes little as an energy absorbing factor in a study of the elastic performance of a textile under repeated loadings. The elastic performance coefficient developed by Hamburger compares the energy absorption of a material after removal of secondary creep with the energy absorption of the yarn before removal of secondary creep and modifies this ratio by the energy recovery properties of the material after removal of secondary creep. Expressing this in a rough formula we have:

$$\text{E. P. Coeff.} = \frac{W_n}{W_1} E_R$$

where W_n represents energy absorbed in tensile loading of a material from which secondary creep has been removed by previous mechanical conditioning.

W_1 represents energy absorbed in tensile loading of the material from which no secondary creep has been removed (i.e.: first loading).

E_R represents rate of recovery and is a function of rate and magnitude of primary creep after secondary creep has been removed.

Hamburger listed the desirable properties of materials which might be subjected to repeated stressing, "(1) low modulus of elasticity; (2) large immediate elastic deflection; (3) high ratio of primary to secondary creep; (4) high magnitude of primary creep; and (5) high rate of primary creep."

Hoffman[27] also emphasized the importance of the visco-elastic effect in respect to resilience. He presented a generalized concept of resilience, first pointing out that "resiliency" should be used to describe the intrinsic property of a material (such as glass, nylon, wool, etc.) and that "resilience" should refer to a fabricated material (a woolen fabric, nylon yarn, etc.). The geometry of the material causes the need for both the intrinsic and general terms. Glass in the form of a plate has the same resiliency as the glass filaments in a fabric; but the resilience of the two materials is quite different. Hoffman summarized his conception: "The resiliency of a material is a complex stress-strain-time property describing the combination of three parameters—the initial modulus, the extent of recovery from strain, and the change of modulus and recovery with time and strain." He also pointed out four main types of resiliency which exist because of the four possible permutations of high and low moduli with high and low rates of recovery.

V. New Methods of Determining Modulus of Elasticity

The modulus of elasticity of a material (under tensile forces) as defined by Hooke's law is the ratio of stress (load per unit area) to the elongation produced by the stress (increase in length divided by the original length) in the perfectly elastic region of extension (up to the yield point). This turns out to be the slope of the elastic straight-line portion of the stress-strain curve. It may be expressed in engineering terms such as grams per square millimeter per unit strain or in textile terms such as grams per denier per unit strain.

Because of the visco-elastic properties of textile fibers, it is many times difficult to determine just where the yield point occurs. Therefore, it is frequently impossible to obtain the elastic modulus for these fibers. Furthermore because of

this complex behavior of fibers, we are not always interested in only the modulus of elasticity at low loads; but we may want to know the modulus of elasticity at any stress or strain at any time. The determination of such modulus values is difficult using standard techniques.

Silverman and Ballou[28] developed a method for determining the modulus of elasticity of textile materials by measuring the velocity of sound transmitted through them. The fundamental relation between the velocity of sound in a material and its modulus is expressed in the equation:

$$V = \sqrt{\frac{E}{d}},$$

where V is the velocity of sound, E is the modulus of elasticity and d is the density of the material. The method consists in simple terms of the transmitting of a sound wave of known frequency through the material by means of a vibrating rochelle salt crystal and the determination of the wave length by a movable pick-up rochelle salt crystal. From the wave length, the velocity of the sound and thus the modulus of the material may be calculated.

It is obvious that while using the Ballou and Silverman technique either static or dynamic tension may be applied to the fiber, and the changes in modulus with time studied. Many changes in the fiber (such as molecular structure) can be more readily investigated by this new tool.

Hamburger and co-workers[29] have refined and improved this sonic method of textile testing, extending its range and its precision.

VI. Geometry of Textiles as a Factor in their Performance

It was mentioned earlier that Pierce[9] was one of the first to realize the importance of the geometric structure of textiles as a factor in determining their performance in service.

Smith[8] discussed generally the effect of fiber shape and dimensions on the properties of a fabric. These are the primary geometric or "form" factors above the molecular level which affect textile performance.

Superimposed upon these are staple length, twist in the singles yarn, twist in plied yarns, type of weave and so on. Starting with a very complex material, the textile fiber, and then building it up into an intricate fabric structure creates a tremendous problem in analysis and correlation of each minute but important factor so that a rational picture of performance in terms of these factors may be obtained.

Balancing of elongations of the components of parachute fabric and cord by proper geometrical construction has been shown by Hamburger[30] to produce more efficient performance in each. For instance, in the parachute cord there is a core yarn covered by a braided cover. In the usual construction the core of the cord has considerably less elongation under tension than the cover. Therefore, because the core will reach its ultimate elongation before the cover will, the total strength of the combined strengths of the two elements will never be realized. By altering the geometric structure of the parachute cord so that the ultimate elongation of the two elements was more nearly alike, it was possible to obtain nearly 100% of the combined strength of the elements.

"Form factors" depending upon the geometry of textiles enter into their abrasion properties as indicated by numerous investigators including Hamburger[31], Hamburger and Lee[32], Kaswell,[35] and others.

Finch[33] discussed the effect of geometry on the compressional behavior of textile materials. He emphasized that compressional characteristics of a textile are not only dependent upon the fundamental properties of the fibers such as exhibited in the visco-elastic effects but upon the geometry of the fiber and the superimposed geometry of the fabric. Much work is still necessary before the laws of the compressional "deformation process applied to a complex structure of a fabric" will be solved. He refers to Pierce's suggestion[34] that simplifying assumptions in the derivation of these laws should make the approach somewhat simpler.

VII. Significance of Recent Textile Research

It is realized that this brief review of some of the recent advances in the study of textile fibers and their products has neglected some phases of such research and many of the investigators. However, it should be evident that fibers are extremely complex materials that are fabricated into equally complicated structures. Furthermore, it is clear that a truly scientific approach is being used in studying the fundamental structures and properties.

From works of this nature have come textiles which perform more efficiently in the jobs intended for them. That these advances will continue is evidenced by the unremitting interest shown by the textile research groups, the manufacturers, and the consumers.

Although tremendous strides in textile research have taken place since Harold deWitt Smith gave his Marburg lecture[8], his closing remarks are still pertinent to the recent work summarized in this paper. "The engineer, or textile technologist with an engineering viewpoint, now has the opportunity and the responsibility of bringing the scientific knowledge about textile fibers down to earth in order to give the textile craftsman and technician the means of understanding and using such knowledge for the benefit of the industry and the textile consumer.

"There is a great deal to be said for the engineering approach to the translation of theories and experimental facts into the concrete reality of useful objects, such as industrial fabrics, household furnishings and clothing; for the engineer's role in textiles, as in all other spheres of activity, is to catalyze the union of theoretical exactitude and practical reality by the liberal application of well-founded textile common sense."

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THE CO-OPERATIVE SYSTEM OF EDUCATION AND ITS APPLICATION AT LOWELL TEXTILE INSTITUTE

Simon Williams[a]

I. INTRODUCTION

During the summer months of 1948, Lowell Textile Institute formally initiated the Co-operative System of Education, on a limited, voluntary basis, thus marking a highly significant addition to the educational opportunities available at the Institute. Fifteen students, selected from a volunteer group meeting minimum academic standards, were placed in eight participating mills and the outstanding success of this initial experiment strongly re-emphasized our belief in the value of the co-operative concept and gave tremendous impetus to the continued growth of the plan. It is anticipated that by the summer of 1949, the initial fifteen students will have increased in number to well over fifty, and it is hoped within five years to have co-operative industrial programs available to the great majority, if not all, of the students.

The importance of the successful development of the co-operative plan at Lowell Textile Institute cannot be stated too strongly and in recognition of the difficulties attendant to the growth of the program, it has been deemed advisable to prepare this review of the aims, and accomplishments of the Co-operative System in the United States and to define the program as it is planned for Lowell Textile Institute. With this story in the hands of the leaders of the textile industry, it is our high hope that a close and permanent liaison will be effected between the industry and the school in the achievement of a common educational goal.

II. WHAT IS THE CO-OPERATIVE SYSTEM OF EDUCATION?

In October, 1946, the Committee on Aims and Ideals of Co-operative Education of the Society of Engineering Education published the following definition of a co-operative college of engineering(1)[b]:

Such a school shall be one:

1. In which curricula lead to the bachelor's degrees in engineering or to both bachelor's and higher degrees.
2. Which requires or permits all or some students to alternate periods of attendance at school with periods of employment in industry during a portion of one or more curricula.
3. In which such employment is constituted as a regular, continuing and essential element in the educational process.
4. Which requires such employment to be related to some phase of the branch or field of study in which the student is engaged.
5. Which expects such employment to be variegated in order to afford a spread of experience.
6. Which specifies minimum hours of employment, and a minimum standard of performance in such employment, among the requirements for a degree.

Point 6 above should be emphasized. The co-operative plan calls for the student to carry a full work load. It is not an observational tour. It is not a field trip. It involves a serious, earnest effort on the part of the student, and such effort is to be expected and demanded by the employer and his staff.

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a. Dean, Lowell Textile Institute.
b. Numbers in parentheses refer to corresponding numbers in the List of References tabulated at the end of the paper.

Further, it must be recognized that the co-operative plan is distinctly different from the practice of many students to obtain employment during the summer months. While such practice is widespread and highly desirable, the work experience in such cases rarely involves a continuous work plan coordinated to an educational program. In other words, the co-operative plan involves a considerable expansion of the experiences expected by routine employment.

While Lowell Textile Institute offers other than engineering degrees and as yet does not require a co-operative experience for graduation, the definition of the Committee clearly embraces the Institute. Further, as is true at Lowell, the Committee points out that "in the popular conception, only those institutions are co-operative in which the co-operative method is sharply emphasized both in policy and publicity."

III. WHAT IS THE PURPOSE OF CO-OPERATIVE EDUCATION?

Dean Herman Schneider, originator of the co-operative system in the United States, in establishing the program at the University of Cincinnati, precisely and comprehensively summed up the philosophical basis of the plan when he said "Theory can best be learned in school; an understanding of man and his mechanism can only be learned where they operate."(2)

Expressed in greater detail, the Committee on Aims and Ideals of Co-operative Engineering Education set forth the following specific purposes(1):

1. To impart firsthand and actual knowledge of and experience with the execution in industry of engineering designs, projects, and developments.
2. To impart understanding of and familiarity with the problems and the viewpoints of workingmen and women.
3. To assist students, by direct and personal experience in industry, to test their aptitude for engineering careers.[c]
4. To enable engineering students to adjust themselves to engineering employments by gradual and easy transition from academic pursuits and mode of life to the requirements of industry.
5. To train and otherwise prepare students especially and directly for the administrative and operating functions which, to a greater or less degree, enter into most engineering careers.

To these objectives could be added many others of great significance, such as the creation of a more comprehensive understanding of mass production, the profit motive, competition, and other concepts basic to the social structure of the United States; the development of a sense of values and balance in determining the importance of subject matter being covered in school; the stimulation of teachers in dealing with better informed, more interested, more critical and analytical students; the contributions to improved subject and curricular design by the constant inflow of experiences with current industrial activity; the creation of a reservoir of ideas to direct the applied and fundamental research activities of the Institute. The general values inherent in the program are almost endless in their variety. It is well to point out an additional, highly important goal of the program at Lowell Textile Institute, namely, *to keep the graduates of the Institute in New England.*

For some years, concurrent with the growth of textile manufacturing in the South and Midwest, there has been a steady drain of trained technologists from the schools of New England to these areas. To meet this competitive challenge it behooves the industry and schools in New England to exercise every possible effort to build and maintain a reservoir of trained supervisory personnel willing and anxious to fight for the survival and healthy growth of the regional textile activity.

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c. In the case of Lowell Textile Institute, this implies not only engineering careers, but careers in production, design, sales, chemistry, finishing, etcetera. The statements of the Committee must be generalized by the reader in order to apply them properly to the conditions at Lowell.

All of the foregoing discussion points clearly to the concrete contributions of co-operative training to the development of technically trained college graduates much more acceptable to the leaders of business and much better adapted to meet the tempo and challenge of industrial life. However, it is important not to overlook the contribution of the plan to the educational institution itself, in terms of its ability to evidence a dynamic flexibility of curricular design as it attempts to meet the educational challenges of the times.

This point is worthy of brief elaboration. The technical institution currently is faced with several problems of unprecedented importance and which require for their solution an intensity of intellectual awareness, honesty, and action beyond anything heretofore exercised. These problems and their import may be summarized as follows:

1. Each institution is attempting to cover an adequate range of subject matter in the basic sciences, the engineering adaptations of basic principles, the practical (industrial) application of these engineering principles, and in the so-called liberal arts or social-humanistic area involving english, history, economics, labor problems, etcetera.
2. Each institution, in its teaching, is attempting to impart a sense of professional pride; and ethical code of behavior; an analytical, discerning, tolerant attitude; an intelligent and active interest in government, citizenship; a strong faith in our democratic way of life . . . all of these in addition to facts and figures relating to the particular disciplines studied.
3. Each institution is faced with the rising demand for higher education, sponsored currently by government financing and population growth, which is bringing larger and larger numbers of students to the colleges, without any concurrent improvement in the selection of those who wish to enter industry or in the guidance techniques and facilities available to conduct properly this growth in mass professional education.

If it can be assumed that the four-year college program was ever adequate to meet its obligation, it is doubtful that it can be said any longer that the job of professional education can be accomplished by the school alone. Critical examination of any and all of the problems noted above reveals the striking complications involved in their solution. The knowledge embraced by the sciences has grown to staggering proportions. Classical generalizations are being challenged and replaced. In the public mind a dangerous reliance upon the sciences has developed as a solution to all social ailments. The selection of scientific subject matter, properly balanced and integrated, has become an ever more complexing task.

Further, even as scientific knowledge has grown, the myriad of new industrial products and methods has made an up-to-date presentation of the practical engineering adaptations of basic scientific principles an almost impossible task. Finally, as we examine the society in which technological activity must survive, and as the whole vital gamut of human behavior becomes variously defined, the pressure to offer students an opportunity to examine man as a biological entity, his history, his culture, his geographical and ecological boundaries, together with advanced work in psychology, economics, sociology, comparative government, labor problems, the legal and ethical assumptions of the various cultural and national groups of the world, and similar subjects, becomes irresistible. In our industrial world, the principles of trade, merchandizing, profit, public relations, etcetera, are also to be considered integral to a well-trained professional student.

It serves no further purpose to elaborate on the multitude of additional arguments that could be presented in pursuit of this theme. Perhaps what has been said will suffice to capture universal agreement that no school, however well-staffed and equipped, can do the job by itself. Whatever extensions of time are imposed on college programs, either by having longer undergraduate periods (e.g. 5-7 years), or by forcing professional training in engineering and related fields into the graduate schools, as has been done with law and medicine, we are faced with the inevitable conclusion that to educate our youth with maximum

effectiveness, in college[d], we must consider that the school is but a part of a community educational resource, and that industry, government, and our social institutions are equally important parts of the educational community. Not only must the schools reach out into these resources, but these groups must assume some of the responsibility heretofore assigned completely to the school.

Hence, it is well to repeat: not only does the co-operative system give to industry better-adjusted graduates, but in placing in industry those educational tasks which it is best suited to assume, it allows for more time in the school program to offer students curricula of greater scope and greater current significance, *without which his experiences in industry would be much less meaningful.*

IV. HOW DOES THE CO-OPERATIVE SYSTEM WORK?

The co-operative plan at Lowell Textile Institute operates as follows:

A. Time for Work and Study

In the completion of the co-operative training program, three twelve-week work periods are planned, occurring during the summer months, from June to September, beginning at the end of the freshman year and recurring at the end of the sophomore and junior years. This adds the equivalent of an additional academic year to the student's program, but does not change the four-year calendar schedule from entrance as a freshman to graduation. Rather, it largely eliminates the summer vacation period.

This phase of the plan at Lowell differs markedly from all other co-operative programs in engineering or technical schools which were surveyed, and should be explained. In most cases, the co-operative plan is in action at schools which operate throughout the calendar year and which are organized on the quarter rather than the semester system. Here, the work period generally lasts one quarter and the study period, one quarter, and the two alternate throughout the year, over the years. Since Lowell Textile Institute does not support a summer school and from the viewpoint of its academic activities is essentially inactive at this time, the quarter system obviously could not be introduced.

Secondly, in practically all other schools, the work-study plan involves a minimum of five calendar years and also places the student on the job from two to three times more frequently (and hence, in total time, two to three times longer) than is planned at Lowell Textile Institute. Beyond the practical factors mitigating against a closer similarity between the plan at Lowell and at other institutions, the following considerations were involved:

1. Lowell is much more highly specialized than most technical schools. A considerable amount of classroom and laboratory time relates directly to machines and finished articles, closely comparable to those met in industry. In more general courses in technology, such as electrical, civil, mechanical, and chemical engineering, the engineering laboratories relating to motors, unit processes, materials, etcetera, still remain abstract in relation to the processing of given raw materials and the production of given finished products. Therefore, in its guidance and orientation aspects, the very specialization in the school itself tends to offer to the student at Lowell a significant share of what other co-operative students gain through industrial experience. This statement is not meant to gainsay the value of more work time than the Lowell co-operative student will cover, but perhaps it may indicate why it is felt that the lesser work period does not lose in value in direct proportion to the time involved.
2. The addition of a fifth (or more) year to the undergraduate program involves a serious decision in terms of expense, both in time and money, to most students. It is the conviction at Lowell that until all possibilities have been exhausted in utilizing the present four-year period with greater imagination and efficiency, the addition of a fifth year is a

d. The extension of this argument into the most important area of primary and secondary school education is beyond the scope of this paper, although it is recognized as being integral to to the problem.

questionable procedure. Correlative to this belief, it was felt by using the hitherto unused summer period, despite the fact that only three work periods would be involved, the student would gain so greatly and the return to the Institute would be so significant, that the four-year program currently in effect could be retained and critically analyzed for some years to come, with justification. Further strength was given this conclusion by placing the major emphasis in the co-operative program on the psychological experiences and maturation of the student rather than upon the development of any special skills.

B. Selection of Co-operative Students

The plan at Lowell is voluntary. Since opportunities for all students are not yet available, it could not be otherwise.

In the spring, the freshmen are notified of the co-operative openings and those interested are asked to register their interest, selecting a first and second choice. Those signing up are then screened for a minimum academic attainment, which reflects their ability to meet minimum graduation requirements for grade average, as expressed in the official school Bulletin.

The mills are then notified and the representative of each mill interviews the interested students and selects his particular student or students. Since the attempt has been made to include textile operations in all phases of the industry, students have the opportunity to work in mills whose activity fits into their major field of study.

C. Responsibility of the Student

1. As will be noted later, the design of the work program in each mill is predicated on the three summer periods and involves a continuing development comparable in every respect to the building of curricula from elementary to advanced study. Therefore, when a student is selected by a mill at the end of the freshman year, he is expected to spend all three work periods with the same mill. This is an ethical contract and the student can drop from the co-operative program and, except in extenuating circumstances, his only penalty will be reflected in his being barred from further participation in the co-operative program. Similarly, the mill is expected to retain a given student. However, if the mill rejects a student after one or more work periods, upon consultation with the school, the student will again suffer the penalty of being denied further co-operative participation. Such a history becomes a permanent part of the record of the student.

There has been some critical discussion relative to confining the student to one mill for his entire experience. While there are unquestioned benefits to be obtained from brief work experiences in three different business organizations, this criticism may be answered in part by pointing out:

a. That, since even three mills would cover only a fraction of the total activity of the textile industry, the gain in viewpoint would be more than offset by the losses in psychological experiences reflected by a lack of continuity. It must be remembered that any textile organizaztion is exceedingly complex and even three work periods in a mill or a selling house is at best a casual introduction to the textile industry. It is admitted that skills and complete aptitudes are not the objective of the program. It is also true that a more deep-rooted awareness of jobs and people, the flow of materials, the complexity of survival and competitive factors, is being sought, along with the highly important aspect of guidance or assistance in determining, in the mind of the student, whether or not his choice of a textile career has been sound. These latter products of the program cannot be attained by changing environments each work period. This viewpoint has apparently been reached by other institutions practicing co-operative system, since even in the fields of general engineering experience they generally insist that the co-operative student remain with a given company over the entire work-study program. (4)

b. That, from a realistic viewpoint, it would be infinitely more difficult to interest the industry unless there existed some more tangible hope of a return on its investment in the co-operative plan, than is possible with students who come and go each summer. In the continuing program, the mills have the very excellent chance of retaining for permanent employment their co-operative students, thus justifying, in the minds of management, the investment. However removed from the full idealistic concept of education this reality may seem, its existence cannot be denied.

2. The student is under *no* obligation to accept employment, upon graduation, with the mill in which he obtains his co-operative experience. It is expected, and the experience at other schools substantiates this expectation, that many students will be offered permanent positions and will accept such offers. In fact, it is the hope of the program that they will. However, no pressure to this end exists.[e]
3. At the end of each work period, the student is expected to write a report evaluating his experiences.

D. The Work Program

As has been previously indicated, each work program is designed on the basis of three consecutive periods. The approach to all mills involves two primary assumptions, namely:

1. That the function of the school is to insure that each program is primarily an educational experience.
2. That it would be presumptuous for the school to plan the exact application of time in the mills. Therefore, this responsibility is left entirely to the mill.

The result of this approach has been that the work programs in all co-operating mills vary markedly from one another, but the educational aspects of each have much in common. To illustrate:

In all cases, over and above the actual jobs to which the students are assigned, regular opportunities have been afforded to meet with various representatives of management for general discussions of the textile industry as seen through the eyes of a successful executive. It matters little what subjects are discussed. The value of these talks lies in the exhilarating experience for students to meet and talk informally with industrial leaders. Permanent impressions can be created by such contacts that enrich and enliven a student's attitude. Further, the students are afforded the privilege of examining the labor relations activities of the mill, its methods of buying and selling, its inventory problems, and other aspects of managerial activity. Yet, from mill to mill, the job assignments and the time allotted to each vary strikingly. In some cases, it is planned that the first summer be used for an over-all "tour" throughout all operations, whereas in subsequent years, the student can select his work area in any phase of the operation in which he may be primarily interested. In others, the entire operation is divided into three logical units, one summer to be devoted to each unit.

To satisfy union-management contracts, the students work as trainees and do not replace regular employees. Payment is generally set at the minimum hourly rate paid by the mill, irrespective of the job assigned. For the most part, the students work with and under the regular operators. However, it has been shown that students can and do carry full job loads, particularly as fill-ins for absentee employees. Since the program occurs during the summer months, when vacations and absenteeism for other reasons is high, it has been found that the co-operative student is far from a liability.

In general, the program is most successful when its prosecution is assigned to one person in the mill, generally in the labor relations department if one exists, and the work schedule planned in detail, for all three summers, prior to the inception of the program. Currently, all programs have been so evolved and it

e. It is interesting to note that across the United States, companies hiring co-operative students after graduation find that this group of employees reflects the lowest turnover of any other group in their employ.

as been possible to give copies of these "work outlines" to the co-operative tudent. The details of these programs are too comprehensive to be included 1 the paper. Copies of the outlines are available to interested persons upon equest.

V. CO-OPERATING MILLS

The following organizations have entered into the plan and employed students n 1948:

Merrimack Manufacturing Company	Lowell, Massachusetts
Newmarket Manufacturing Company	Lowell, Massachusetts
Chicopee Manufacturing Corporation of N. H.	Manchester, New Hampshire
Waumbec Mills	Manchester, New Hampshire
Verney Mills	Manchester, New Hampshire
Verney Mills	Peterborough, New Hampshire
Barre Wool Combing Company	South Barre, Massachusetts
Arlington Mills	Lawrence, Massachusetts

In addition, for 1949, two additional mills will participate, namely:

Chicopee Manufacturing Corporation of Mass.	Chicopee Falls, Massachusetts
Cheney Brothers	Manchester, Connecticut

At the time this bulletin is being issued, negotiations are under way with a ariety of other companies, with promising prospects.

VI. CONCLUSION

The most apt conclusion to the foregoing discussion lies in the following tatement received from the Merrimack Manufacturing Company, Lowell, Massachusetts, which underlines why this company feels the need of the cooperative lan and *why the textile industry as a whole must develop such a training rogram*:

"Although the textile industry is the oldest in the field of manufacturing and is the employer of the greatest number of people, it has found itself gradually falling behind in the industrial picture. This can be attributed to many reasons. Some of the more important might be age, marginal operation and inability to apply mass production methods efficiently. Probably the greatest handicap is the fact that it is centuries old. So old that many of its troubles have come to be taken for granted. It is an industry so basic and essential to civilization and our way of life and so dependent upon the fruit of the earth that, like the farm industry, it has operated on a marginal basis. An industry two centuries old in this country can't help but have physical layouts which do not readily lend themselves to modern mass production methods. While a great deal of progress has been made both in its marginal characteristics and production methods, much has yet to be done in the field of worker-employer relations. Because of its age the powerful backward drag of history and tradition has placed the textile industry, particularly in cotton fabrication, in an unfavorable position. This, in part, is due to the kind of management the cotton textile industry has developed. From a strictly technical standpoint, textile management personnel compares very favorably with any other kind of industry. Perhaps where the greatest fault lies is in the inability or unwillingness to accept the emancipation of labor. This is not strange but rather to be expected when we consider the ideologies of an ancient industry have been handed down from generation to generation.

"The picture is rapidly changing due to certain economic and scientific developments. The industry has lost much of its marginal characteristics and is offering a minimum wage comparable to that found within industry in general. Through discovery and application of various synthetics, the struggle to hold the cotton market has become keen. In the past the industry has not been very attractive remuneratively to the modernly trained young man. Fortunately, however, during the past few years textile management has become aware of this deficiency and there is evidence of a movement to correct this fault and to supply this basic and vital need.

"The textile industry naturally looks to the engineering schools throughout the country for its supply of technically equipped men as it has for the past several years. The fallacy, however, is found in the indisputable fact that no industry today is

efficiently managed from the sole basis of technical know-how. There is another equally important phase of engineering to which industry is only now becoming alert. Human engineering is equally as important today as technical knowledge if not more so. Industry is beginning to realize that man existed before the machine and that all the technical brilliance available cannot assure the efficient and economical operation of the industry if the worker decides differently. Unfortunately the colleges are in no position at present to provide anything other than theoretical lip service to this all important factor. The only place this experience and knowledge can be acquired is alongside the worker himself. Only by becoming a worker can the technically trained college man become truly cognizant of the intricate problems of modern management and come to realize that despite an advanced machine age, man is still the most important factor.

"The textile industry in general must concern itself with getting into the industry executives who understand the imperative need for human engineering, the lack of which is threatening the survival of industry — and even our capitalistic system.

"To this end the Merrimack Manufacturing Company and the Lowell Textile Institute has entered into this co-operative training plan as outlined herein."

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[f] Complete bibliography included in this article.

Southwick Hall Louis Pasteur Hall

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HISTORICAL SKETCH OF THE LOWELL TEXTILE INSTITUTE

The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provide for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. This authorization represented the culmination of a movement initiated June 1, 1891, for the establishment of the School. On January 30, 1897, the School was formally opened by Governor Roger Wolcott in rented quarters in the heart of the city. It was not until January 1903, that Governor John L. Bates dedicated the first building of the present physical plant.

In accordance with the acts of incorporation, the school functioned as a private institution, with state aid, under the authority of a Board of Trustees consisting of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the schools of Lowell, and a representative of the Textile Council were members ex-officio. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees for periods of four years each.

In 1918, by virtue of a decision forced by the passage of the anti-aid amendment to the State Constitution, forbidding state aid to private schools, the property of the school was transferred to the Commonwealth of Massachusetts on July 1 of that year, and the control and management of the school was vested in a Board of Trustees appointed by the Governor.

In 1928, by virtue of legislative act, Lowell Textile School became known as Lowell Textile Institute in order to define more clearly the standing of the institution.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textiles and kindred branches of the industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the Southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

During the early years of the Institute, in keeping with its initial educational objective, no degrees of any kind were offered and all graduates received diplomas upon the satisfactory completion of their work.

The passage of years since the establishment of the Institute, however, has seen many fundamental changes in the industry and its relationship to society. New fibers, new machinery, new auxiliary materials, new merchandising techniques have followed one another in bewildering array. The dynamics of social behavior, the changing position of labor, the shifts in international competition concomitant with shifts in foreign policy, all have tended to re-focus our attention on new educational objectives, with lesser emphasis on the purely vocational aspects of our program. The challenge of world events which have integrated the multiplicity of man's knowledge in the humanities as well as in the sciences, has made change inevitable and desirable in the traditional patterns of the curricula at Lowell Textile Institute.

Thus, in 1913, the Institute granted its first degrees, those of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.). In 1946, these degrees were further modified to reflect more clearly the scope and quality of the undergraduate program; and the class of 1947 was the first to re-

ceive the Bachelor of Science (B.S.) degree from Lowell Textile Institute. The specialized diploma courses have been discontinued and all of the vocational training has been placed in the night school program, described in a separate bulletin.

In making these curricular changes, the administration has kept clearly in view the fact that the Institute is training its students to enter the textile and related industries. The mechanical equipment of the Institute includes the best makes of textile machinery and the students continue to receive considerable instruction in the handling and manufacture of the various textile fibers. The fundamental educational basis for this manufacturing program, however, has expanded along lines found to be successful in engineering colleges throughout the country, and includes a diversified group of courses in English, social sciences, and the physical sciences, as well as a nucleus of engineering and applied Chemistry courses, which attempt to integrate the fundamental and applied points of view. All curricula are based on the notion that the college program cannot adequately train the specialist; it can only predispose the student's thinking along special lines, giving him a broad basis from which to develop further an imaginative point of view; a tolerant, questioning attitude; and certain ethical values governing his relationships with other men.

The administration and faculty at Lowell Textile Institute regard the curricula as dynamic, experimental concepts and constantly are seeking for new educational methods capable of better meeting the challenge posed by the instability of modern world society. This objective will be kept constantly in view; and, as new demands are presented, every effort will be made to extend courses, equipment, and floor space.

COEDUCATIONAL

Within the last few years, the possibilities for women in certain branches of the textile field have become recognized; and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some, since it offers a broad training that prepares for many lines of activity. For those who wish to specialize in textile designing and art, the Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

BUILDINGS, GROUNDS, AND EQUIPMENT

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Textile Avenue, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department, the Woolen and Worsted Yarn Department, the Department of Synthetic Textiles, and contains on the lower floors equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three-story addition was placed on a single-story building erected in 1910 and previously known as the Colonial Avenue Building. This Hall contains on the first floor the Cotton Finishing laboratory as well as classrooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry, Textile Coloring, and Finishing Department.

Through the generosity of Mr. Frederick Fanning Ayer, the Institute has been provided with a campus and athletic field of about 3 acres. In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will be further improved to make a modern athletic field for baseball and other sports.

The equipment in the various buildings is extremely varied and includes textile machinery covering all of the basic systems for handling staple and continuous filament fibers from raw material to finished fabric. The textile equipment is closely integrated to modern laboratories in physics; chemistry; engineering; and chemical, physical and optical testing. All laboratories, including those with machines which are exact replicas of commercial models, are geared to both teaching and research.

Dormitories. Modern, attractive living quarters are available for students in the two dormitories which are situated directly across the street from the main Institute building.

All Freshmen, except those who must live at home, are required to live in a dormitory which is designed exclusively for the use of entering students. Information concerning procedures for applying for rooms, rates, and other data will be sent to prospective freshmen concurrently with notice of the acceptance of their candidacy for admission.

Upperclassmen have their accommodations in Smith Hall, which was dedicated in April, 1948, in honor of James T. Smith, pioneer educator in the textile field and the man primarily responsible for the organization of Lowell Textile Institute.

Present dormitory accommodations afford facilities for 224 men — 112 men in each unit. A faculty member serves as proctor in each hall, and provision has been made for the medical, nutritional, and social welfare of the dormitory residents. The cafeteria in Smith Hall caters to the entire student body and faculty of the Institute.

For further information concerning the dormitories, write directly to the Office of the Dean.

Library and Reading Room. That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain books in a wide variety of fields of interest, with an emphasis on textiles, art, chemistry, and engineering. All of the significant scientific journals in textile and allied fields are available, as well as journals of general interest.

Plans are under way for a new library building which will greatly expand the study and reference facilities available.

SPECIAL SERVICE

In recognition of the unique research opportunities afforded to the textile industry by virtue of the equipment and staff available at Lowell Textile Institute, the Institute has been authorized by the Massachusetts State Legislature to conduct research, development, and consulting programs under contract to responsible agencies. This activity has the effect of permitting staff members access to new and significant developments in the textile and allied industries and materially assists in keeping the teaching programs current and dynamic.

ADMISSION

Policy — New students at the Lowell Textile Institute are selected by a group of Faculty members functioning as the Committee on Admissions. The Committee endeavors to accept for membership in the freshman class those applicants who, during their preparatory education, have shown evidences of promise in scholastic ability, strength of character, and leadership. In addition to test results, scholarly attainments, and other traditional standards of measurement, the Committee sets a high value on the personality characteristics of each individual candidate, together with his extracurricular interests and contributions to school and community life.

Procedure — Formal application for admission should be made as early as possible in the candidate's senior year of secondary school. Requests for application blanks and all correspondence relating to matriculation at the Institute, should be addressed to the Chairman, Committee on Admissions. Preliminary correspondence before the senior year is welcomed, and encouragement is extended to every effort which will tend to harmonize the prospective student's interests and activities with his freshman year at the Institute.

Steps to be taken for admission are:

1. Pages one and two of the admission application form should be completed by the candidate.

2. The whole application form should then be submitted to the office of the candidate's secondary-school principal, with the request that his office fill out pages three and four and mail the completed application directly to the Chairman, Committee on Admissions.

It is required that this procedure be accomplished by March 1, if the candidate wishes to be considered for admittance to classes beginning the next September. It is the responsibility of each individual applicant to ensure that his application has been properly completed and sent to the Committee at the Institute before March 1.

3. Application should be made to the College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey, preliminary to taking certain examinations described below under the heading Requirements.

4. Each applicant must submit to a complete health examination by his family physician. A certificate of good health, indicating the date of this examination, must then be sent by the physician directly to the Chairman, Committee on Admissions. No application for admission will be considered by the Committee until this certification has been received. The Committee has prepared a special form for the convenience of the physician; a copy of this certificate of health will be supplied on request.

5. A personal interview with a member of the Committee on Admissions is strongly recommended.

The Office of Admissions at the Institute is open for this purpose Monday through Friday, from 8:30 a.m. to 5:00 p.m. during the school year. It is suggested that appointments for an interview be made in advance.

Requirements — Fulfillment of prescribed requirements does not automatically constitute the acceptance of a candidate. The final decision as to the eligibility of an applicant shall be left to the discretion of the Committee on Admissions.

The conditions under which an applicant may be accepted are as follows:

1. A candidate for admission must be a graduate of a secondary school approved by the New England Entrance Certificate Board, the Regents of the State of New York, or a Board of equal scholastic standing.

2. (a) Because of the specialized nature of the various curricula at Lowell Textile Institute, it has been deemed advisable that all entering students shall have completed the following units of secondary-school study:

Algebra (quadratics and beyond)	2 units
Plane Geometry	1 unit
English	4 units
American History	1 unit
Chemistry (including laboratory)	1 unit
Physics (including laboratory)	1 unit
Trigonometry	½ unit

In addition to the above-listed prerequisites, each applicant must offer credit in elective subjects, such as: languages, other than English; history, other than American; mechanical drawing, solid geometry; advanced algebra; scientific subjects; social studies; and others.

(b) The combined prerequisites and electives should total at least 15½ Carnegie units. Each such unit of preparatory credit is the equivalent of one secondary-school subject satisfactorily pursued during one academic year of at least thirty-six weeks of four forty-minute meetings each week, or the equivalent.

(c) In evaluating the credits offered by an applicant for admission, the Committee will be guided primarily by the quality of his scholastic record and by his apparent promise on grounds of intellect and character. Therefore, an applicant whose preparation has not followed the normal pattern with respect to the accumulation of unit credits should not hesitate to apply for entrance, provided that the quality of his scholarship gives evidence of ability to do college work and provided that he is recommended by his school. (For additional information, see paragraph "Exceptions to Admissions Rules", below.)

3. All candidates must arrange for and complete the following tests, which are given by the College Entrance Examination Board:

(a) Program 2 — the Scholastic Aptitude Test and Intermediate Mathematics Test (three hours).

(b) Program 4 — an Achievement Test in each of the following:

physics — one hour
chemistry — one hour
social studies — one hour

(Students from foreign countries may substitute the test in spatial relations for the social studies test, if they so desire.)

These examinations are prepared, administered, and graded independently of the Lowell Textile Institute. Therefore, application to take the tests must be made directly to the College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey. Arrangements to take the tests, which are scheduled annually for the early part of March, should be completed as early as possible in the candidate's senior year in secondary school. Foreign students, particularly, should plan to make early arrangements, so that testing facilities can be set up near their homes. The examinations are given at various cities throughout the world, so that no candidate should be placed under undue hardship in taking the tests.

Questions concerning the nature and scope of the tests, the location of testing centers, financial considerations, and the like, should be addressed directly to the College Entrance Examination Board. It is the full responsibility of each candidate for admission to Lowell Textile Institute properly to arrange for and complete the required tests.

Advanced Standing — A few exceptionally well-qualified students are admitted to advanced standing each year. Such candidates must submit their qualifications on a special form which must be filed before March 1, if the applicant expects to enter classes beginning the next September; — before November 1, for second-semester classes. The Advanced Standing Petition should be filed in addition to and independently of the regular admissions application; the former should be sent directly to the Committee on Admissions by the candidate himself; the latter should be sent to the Committee by the candidate's secondary-school principal.

Transfer students are expected to have demonstrated outstanding ability, must submit transcripts of their college record and letters of honorable dismissal, and must supply cogent and positive reasons for wishing to enroll at Lowell Textile Institute. While every effort will be made to grant acceptable applicants for advanced standing full credit for previous college and/or military training courses, the final decision in this matter will rest with the Head of the Department concerned.

Because of the nature of the course of study at the Institute, it is usually difficult for a transfer student to construct a program which will be completely satisfactory. In general, a transfer can be accomplished only at the expense of sacrificing some time and credit. With that thought in mind, the Committee entertains consideration of advanced standing applications only when they include a well-developed plan of study, which the candidate submits as being acceptable and suitable for his purposes. The Chairman of the Committee will gladly advise prospective applicants concerning this plan of study, and other matters concerned with advanced standing, by means of correspondence, or interview, or both.

Occasionally, an undergraduate may leave the Institute to study elsewhere after which he wishes to return to the Institute. Re-entry under such conditions is by no means automatic. Each application will be considered in the light of its individual merits. Credit for courses taken at other institutions will be given wherever feasible, but the Faculty reserves the right to require that candidates for re-admission take such subjects as it deems necessary in the construction of a sound program, even though the course material may have been previously studied. Since each individual case is different, no hard-and-fast rule can be laid down, but in general, credit will be given only when good or superior work has been demonstrated.

Special Students — Although most applicants for admission will wish to enroll for the full four-year degree program, a few persons may wish to take specialized work without regard for degree credit.

Special students usually are expected to conform to the general rules and regulations as specified by the Faculty. Their plan of study may not be of a nature as to deviate markedly from the regularly formulated subject matter and laboratory courses; and acceptance to special status is contingent upon the consent of the instructor in charge of each course to which admittance is sought.

The Committee admits only a few highly qualified students to special status each year. For detailed information concerning specific programs, applicants should communicate directly with the Chairman of the Committee on Admissions.

Foreign Students — Each year the Lowell Textile Institute regularly accepts for admission up to a maximum of 5% of the total number of students in any given class (freshman, sophomore, etc.) from foreign countries. There are no special procedures to be observed by alien candidates, although it is urged that they endeavor to have the transcript of their secondary-school and/or college records, as well as all other admission materials, submitted in English, as early as possible in their final year of secondary school. It is assumed that all applicants have a considerable facility in speaking and writing English, and that they have financial resources sufficient at least for their first year of study. It should

be emphasized that foreign students will be expected to complete the same schedule of courses as is assigned to all other students.

It is suggested, as noted above, that early arrangements be made with the College Entrance Examination Board to have a testing center located near the candidate's home. In order not to work a hardship on alien applicants, the Committee permits such candidates to substitute the spatial relations test for the achievement test in social studies. In all other respects, the admission procedures for foreign students are identical with those required of U. S. citizens.

Exceptions to Admission Rules — In special cases, at the discretion of the Faculty Committee on Admissions, applications may be accepted from candidates in the following categories:

1. Applicants who lack credit in specified required subjects because they are not offered in the course of study at their secondary school. Such applications will be considered only when the quality of work done in other departments is exceptionally high.

2. Applicants who offer credit in all the required subjects, but whose accumulation of unit credits does not total 15½. Very few students will find themselves in this category, because most secondary schools require at least 15½ units for graduation. However, the Committee is willing to recognize the possibility that a student, well-qualified in all other respects, should not be denied the opportunity to submit his application because of purely quantitative considerations.

3. Applicants who have not maintained a uniformly good scholastic average in all subjects, *but are otherwise acceptable,* may be required to pass certain tests given by the College Entrance Examination Board. These tests will be in subjects prescribed by the Committee on Admissions, and usually will be in addition to the examinations regularly required of all candidates.

4. Applicants from secondary schools which are not on an accredited list may be required to pass the tests of the College Entrance Examination Board in those subjects prescribed by the Committee on Admissions, in addition to, or in substitution of, the tests regularly required of all candidates.

ORIENTATION

Each freshman is expected to be in daily attendance beginning Wednesday, September 14, at 9:30 a.m., and to follow the prepared program which will be placed in his hands at that time. Late registration for all students at the Institute is subject to a five-dollar fine, unless accompanied by a medical or equally acceptable excuse.

Freshman Week — Freshman Week will be devoted to facilitating the adjustment of the beginning student to his new physical and social surroundings. Under the joint sponsorship of the Faculty Committee on Guidance and the Student Council, a program of meetings, lectures, and conferences will be presented in order to acquaint the entering class with the traditions, customs, rules and regulations, courses of instruction, organizations, recreational and other facilities of the Lowell Textile Institute.

Faculty Advisors — During Freshman Week, each entering student will be assigned a member of the faculty who will serve as his faculty advisor for the next two years. The advisors function as a counseling link between the student and his academic and personal problems.

Effective Study Course — All new students at the Institute are required to take the course in Methods of Effective Study. It is of one semester's duration, with meetings scheduled once each week, and carries no credit. The course attempts to teach the student how to get the most out of his work at the Institute by efficient use of his time and talents.

GUIDANCE

A committee of faculty members supervises a guidance program which begins with the admissions procedures, continues throughout the undergraduate years, and culminates in the work of the Placement Office.

Because living on-campus is an important aid in helping the new student adjust to college life, it is required that all freshman students, except those who must live at home, take residence in the freshman dormitory.

Guidance in the freshman year stems mainly from the results of the admissions testing program, Freshman Week activities, the Effective Study course, and the work of the Faculty Advisors. These same advisors function throughout the sophomore year, but during the junior and senior years, the heads of departments and the Dean's Office take over primary responsibility for the students' personal and scholastic welfare.

The Office of the Dean is open to all undergraduates at all times to assist the student in attaining his academic objective, and to assure his active, enjoyable participation in the work and affairs of the Institute.

The Placement Office functions as a natural outgrowth of the undergraduate guidance program. This office endeavors to keep Institute graduates in constant contact with the latest developments in the textile and allied industries, so that they may place themselves in positions best suited to their talents and abilities.

THE GRADUATE SCHOOL

By act of the General Court of 1935, authority was given to Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry, Master of Science in Textile Engineering, and Master of Science in Textile Manufacturing to graduate students who satisfactorily complete a program of advanced standing.

The object of these programs is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees from other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to the textile industry.

I. General Admission

An applicant for admission as a Graduate Student must present evidence that he is the holder of a Bachelor's degree in an acceptable four-year course in the pursuance of which he maintained a uniformly high scholastic rating He must also be prepared to submit statements, from persons qualified to judge, that in their opinion he has the ability to pursue graduate work. *Applications for admission to the Graduate School should be made no later than April 15.*

II. As a Candidate for an Advanced Degree

Admission to the Graduate School does not indicate that the student is a candidate for the Master's degree. Application for approval of candidacy for the advanced degree must be filed with the Department Head after the completion of one term of residence and no later than twelve weeks prior to the date on which the degree is to be conferred.

III. As a Provisional Graduate Student

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (I) may be accepted provisionally, provided he satisfied the department in which he wishes to enroll that he is probably able to pursue graduate studies successfully.

The status of such a student will be changed to that of a Graduate Student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of 3.5 (80%).

IV. Requirements for Graduation

To be recommended for the Master of Science degree a student must have fulfilled the following requirements:

a. Completed a course of study approved by the department in which he has been enrolled.

b. Completed a thesis (original research or other investigation, optional with department) approved by the department in which he has been enrolled.

c. Residence of at least one academic year.

d. An average rating of 3.5 (80%) in those courses submitted for graduate credit. All courses submitted for graduate credit, which are normally upperclass undergraduate courses (those offered to juniors and/or senior students) must be passed with a grade of 80% or better.

The exact nature of each student's program will be worked out in cooperation with the major professor and approved by the Head of Department. Every attempt will be made to keep such programs flexible and in keeping with the student's educational objectives.

A graduate of Lowell Textile Institute, or one with equivalent training, can usually complete the work for the Master's degree in one year, provided he continues his major studies in the same field in which he majored as an undergraduate. Other students, or those who change their educational emphasis, will require a longer time, usually two years, according to the number of prerequisite subjects which must be taken.

Special work may be done in the Graduate School, by arrangement with the Graduate School Committee, by individuals not seeking an advanced degree, but who wish to take special subjects or to conduct research to which the facilities at Lowell Textile Institute may be peculiarly adapted. Candidates seeking such status must meet the requirements for General Admission to the Graduate School, as noted above.

TUITION AND FEES

Tuition Fee. — The fee for the day course is $150 per year for residents of Massachusetts, and $250 per year for non-residents. The fee for students from foreign countries is $500 per year.

One-half of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the President for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Student Activity Fee. — A student activity fee of $25.00 is due and payable at the time of the first payment of tuition. This fee combines the former athletic and publication fees and helps support general student activities under the jurisdiction of the Student Council.

Deposits. — Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Board and Rooms. — If space is not available in the dormitories, students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $15 per week and upwards.

Books and Materials. — Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause to machines, laboratory equipment, and other property of Lowell Textile Institute.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (residents of other countries)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Student Activity Fee	25
Machine shop deposit	10
General breakage fee (This applies to students who do not take chemistry or machine shop)	10
Books and supplies (Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50
Late registration fee	5

SCHOLARSHIPS, PRIZES, AND LOANS

Scholarships. — A limited number of scholarships are available at Lowell Textile Institute through funds variously contributed by the textile and allied industries.

1. *New England Textile Foundation Undergraduate Scholarships*

Scholarships of $500 per year are available by means of competitive examination, to students who qualify for entrance to Lowell Textile Institute under the terms described in the Admission section of this Bulletin. *All students interested in competing for one of these awards should make application directly to the New England Textile Foundation, 68 South Main Street, Providence, Rhode Island, no later than January 15, 1950.* Detailed instructions and the necessary application forms will be sent to each applicant accepted for the competition.

2. *New England Textile Foundation Graduate Fellowship*

One graduate fellowship at Massachusetts Institute of Technology is available to eligible candidates for the B.S. degree at Lowell Textile Institute through funds created by the New England Textile Foundation. Candidates must apply to the Scholarship Committee of the Faculty of Lowell Textile Institute.

3. *Berkshire Fine Spinning Associates, Inc., Scholarships*

A number of scholarships covering tuition and living expenses for four years are offered in Textile Engineering and Cotton Manufacturing by the Berkshire Fine Spinning Associates, Inc., Providence, Rhode Island. Eligible applicants are:

a. Male employee of Berkshire Fine Spinning Associates, Inc., who have had adequate secondary school training.

b. High school graduates who are sons of present employees.

Interested students should contact the Berkshire Fine Spinning Associates, Inc., Turks Head Building, Providence 1, Rhode Island.

4. *Chicopee Manufacturing Corporation Scholarships*

Two scholarships for junior students in Textile Engineering or Cotton Manufacturing are offered by the Chicopee Manufacturing Corporation.

The scholarships provide $600 per academic year to residents of Massachusetts and $700 for out-of-state residents. Candidates must be native-born citizens of the United States, with potentialities for both leadership and scholarship. Preference is given to native New Englanders and to those who agree to work summers in approved cotton mills. Each award will be of two years' duration.

5. *Goodall-Sanford, Inc., Scholarships*

Goodall-Sanford, Inc., Sanford, Maine, offers to eligible employees of the company full four-year scholarships, the recipient to receive income at the rate enjoyed by the candidate while in the employ of the company. Successful candidates may choose any textile school certified by Goodall-Sanford, Inc., Lowell Textile Institute being one of these approved schools.

6. *Koppers Company, Inc., Graduate Fellowship*

The Koppers Company, Inc., Pittsburgh, Pennsylvania, offers a graduate fellowship in chemistry to stimulate investigation of various chemicals as textile aids. The fellowship provides for $1,000 per academic year, $500 additional for materials and supplies, and certain funds for other miscellaneous expenses incurred during the research.

7. *Pacific Mills Worsted Division Overseers Association Scholarships*

Several $500 scholarships are supported by the Overseers Association of the Pacific Mills Worsted Division, Lawrence, Massachusetts. The Overseers Asso-

ciation selects qualified candidates, who must then meet with the approval of the Admissions Committee of Lowell Textile Institute.

8. *United Elastic Corporation Scholarships*

Two $500 scholarships are available through the United Elastic Corporation, Easthampton, Massachusetts.

These scholarships have been established primarily for employees of United Elastic Corporation, or members of their families. Other residents of the community, however, may enter applications for consideration.

Qualifications for scholarships include: four years of high school education or its equivalent, residence in Massachusetts, good character and standing in the community, aptitude for technical training, and ability to pass entrance requirements of Lowell Textile Institute.

Granting of a scholarship shall be for a one-year period and further extension will be made in accordance with the initiative and progress by the student during the year. The United Elastic Corporation will, so far as possible, furnish suitable employment to the student during the summer vacation period and following graduation.

All applications should be made through the plant nearest to residence of applicant. Applications from the Littleton area should be made to Dana Norris, personnel manager of Conant-Houghton division, Littleton Common, whereas Lowell area applicants should apply to Andrew C. Jenkins, personnel manager, United Elastic Corporation, Lowell.

9. *Warwick Chemical Foundation in Memory of Walter Nowicki*

Through funds made available by the Warwick Chemical Foundation in memory of Walter Nowicki, scholarships are offered to students in Chemistry at both the undergraduate and graduate levels. This memorial fund was created by the Warwick Chemical Company in memory of Walter Nowicki, an employee of the company who lost his life in the armed services during World War II.

10. *Alumni Association Scholarships*

Scholarship funds under the care of the Alumni Fund Council make available one scholarship a year which covers tuition and miscellaneous fees.

Application should be made through the Alumni Office, Lowell Textile Institute.

PRIZES. — The following prizes are awarded annually:

The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who maintains the highest standing throughout his course in Textile Engineering (General or Cotton Option) or the course in Cotton Manufacture.

The Proprietors of the Locks and Canals on the Merrimack River Scholarship at Massachusetts Institute of Technology. — Several years ago the Proprietors of the Locks and Canals on the Merrimack River, a corporation owning the power rights on the Merrimack River in Lowell, gave to the Massachusetts Institute of Technology a sum of money to provide graduate scholarships to graduates of the Lowell Textile Institute who hold a degree and are recommended by the trustees. Applicants must have maintained throughout their undergraduate courses a high scholastic record and must meet the requirements of the Graduate School of the Massachusetts Institute of Technology.

The American Association of Textile Chemists and Colorists offers a book prize and a junior membership for one year to that member of the graduation class who maintains the highest standing throughout his course in Chemistry and Textile Coloring.

Louis A. Olney Book Prizes. — Prizes in the form of books are awarded each year on graduation day to the successful candidate. The conditions in detail are as follows:

$20 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his third year.

$15 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year.

$15 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry.

Phi Psi Award. — This award is given annually to an outstanding member of the Senior Class on the basis of scholastic standing, leadership, initiative, personality, loyalty, and courtesy.

The award is a pocketbook and leather case set made of ostrich leather and lined with calfskin. Inside each article is embossed the coat of arms of the Phi Psi Fraternity, also the recipient's name printed in gold. In addition, the graduating student receiving this award is presented with a suitably engraved certificate, testifying that this honor has been given him.

Student Loan Fund. — A loan fund is available to needy students through the Lowell Textile Associates, Incorporated. Students may make application for a loan through the Faculty Loan Committee. Repayments on any loan which are made while the student is still in school are interest free. Loans repaid after the student leaves school (for whatever reason) bear 4% interest beginning six months after the date at which the student officially leaves school. Repayments are *not required* until the student separates from Lowell Textile Institute, at which time repayments are due quarterly at a rate of $5.00 per quarter the first year and $10.00 per quarter each year thereafter until the loan is repaid.

Additional payments may be made at any time so as to reduce indebtedness at a more rapid rate.

GENERAL REGULATIONS

ATTENDANCE. — The responsibility for attending classes rests largely with the student. Attendance is expected of all students at all classes. Any absence from classes in excess of one week will be subject to investigation unless previously justified. Prolonged, unexplained absences will be reported to the student's family and may be considered grounds for dismissal from the Institute.

LATE REGISTRATION FEE. — Late registration for all students is subject to a five-dollar fine unless accompanied by a medical or equally acceptable excuse.

MARKING SYSTEM. — A student's work in any course will be marked according to the following definitions:

Number	*Letter*	*Rate Value*
90–100	H	5
80– 89	C	4
70– 79	P	3
60– 69	L	2
50– 59	F	1
0– 49	FF	0
D (Deficient)		

F grade permits re-examination to raise grade to L

D grade indicates that final mark is withheld pending completion of basic requirements of course

Credit Hours, which are the basis for graduation, are assigned to each course. The value in credit hours for each course given at Lowell Textile Institute is shown with each course description later in this bulletin.

Cumulative Point Average, upon which honor and probationary status depend, is calculated as follows:

Each letter is assigned the rate value indicated above. Each course is assigned a credit hour rating, as shown in the section of this Bulletin entitled "COURSE DESCRIPTIONS". For each credit rating multiply this rating by the rate value indicated by the grade obtained, add the total for all courses, and divide by the total number of credit hours taken.

EXAMPLE

Course	*Credit Hour Rating*	*Grade*	*Credit Hours X Grade Rate*
A	2	H	10
B	4	C	16
C	1	P	3
D	5	P	15
E	3	L	6
Total	15	Total	50

$$\frac{\text{Sum of Credit Hours x Grade Rate}}{\text{Total Credit Hours}} = \frac{50}{15} = 3.33$$

Probation. — Ordinarily, a student will not be dropped from the Institute without previous notice to the student and his family of the possibility of such action. If the record of the student is so poor that every indication points to his inability to proceed further with the college program, he may be requested to leave school at a given time. If the record of the student shows some promise, but demands an improvement in order to meet academic requirements, he will be placed on probation.

If the point average falls to 2.25 or below in a given semester, the student is placed on probation. If a student is placed on probation, the probationary period constitutes the entire semester following the issuance of the probationary status, and a student, to continue school, must bring his point average above 2.25 during this period.

Probationary status implies: (1) that failure to raise his grade to 2.25 or better will, except under unusual circumstances, result automatically in dropping the student from school, (2) that while on probation, a student may not represent the Institute in any public function, (3) that while on probation, a student may not hold class or other offices which will require a significant portion of his time without the specific consent of the Dean.

Requirements for Graduation. — In order to receive the degree at the end of the four-year program a student must conform to the following limitations:

1. Maintain a minimum 2.50 cumulative point average.
2. Evidence no failures in the courses taken in the major department.
3. Complete the prescribed curriculum with no substitutions for courses in the major department.
4. Offer acceptable, equivalent substitutions for any permanent failures. In this regard, substitute courses, taken either at Lowell Textile Institute or at any recognized collegiate institution, must be in an identical area of learning to the course(s) failed.

Withdrawal. — The continuance of any student on the rolls of Lowell Textile Institute, the issuance of grades, the conferring of degrees, and the continuance of any of the traditional relationships between the student and the Institute shall be strictly subject to the discretionary powers of the Institute. Lowell Textile Institute expressly reserves the right and the student expressly concedes the right, to require withdrawal of any student at any time and for any reason deemed sufficient to it.

STUDENT LIFE

Extra-curricular activities are vigorously encouraged. With organization of the first general Student Government in the winter of 1948 and with the completion of the first dormitories in the history of the Institute, extra-curricular activities are expected to expand widely in both athletic and non-athletic areas. At the time of publication of this Bulletin, the following student activities are functioning or are in process of organization.

Athletics. — All students, by virtue of payment of the student athletic tax, are members of the Athletic Association and are represented by an executive council of sixteen, consisting of the president and the athletic representative from each of the four classes, the captains and the managers of the three varsity sports, and one representative each from the Pickout and the Textile Players. This Council acts as an advisory body to the Athletic Director, has charge of social and athletic events run by the Athletic Association, and ratifies the awarding of letters and appointment of student managers in the various sports.

The schedules of all sports are arranged with the interest of both the Institute and the individual members of the teams in mind. Admission to all home contests is included in the athletic fee which is paid by each student at the time of registration.

Football, basketball, and baseball teams are supported by the Institute and compete regularly in intercollegiate competition throughout the Northeast.

Clubs:

1. Student Chapter, American Association of Textile Chemists and Colorists
2. Engineering Society
3. Glee Club
4. International Club, for foreign students
5. Orchestra
6. Rifle Club. The Rifle Club participates in intercollegiate matches
7. Student Discussion Group
8. Textile Players, the dramatic club

Fraternities and Sororities. — Four fraternities are organized and are located in their own houses close to the campus, namely: Alpha Epsilon, Delta Kappa Phi, Omicron Pi, and Phi Psi. These fraternities are coordinated through the Interfraternity Council.

One sorority, Phi Sigma Rho, is available to the girls.

Honorary Society. — Tau Epsilon Sigma is the scholastic honor society. Only seniors, who have maintained a high scholastic average for their first three years, are eligible.

Publications.—The *Text* is published bi-weekly by the students and the *Pickout* is published as an annual "Yearbook." These publications offer excellent journalistic experiences to interested students.

Student Political Groups. — The Student Government of Lowell Textile Institute and its duly elected Council represent the student's means for self-expression. Within limits, the Student Government exercises authority over the formation of new student activity groups and serves to stimulate and encourage an active, intelligent, extra-curricular program.

Each class has its own elected officers to represent its interests in the affairs of the Institute.

PLACEMENT OFFICE

The Institute maintains a central placement office which has three functions:

1. To assist in the placement of graduating students.

2. To assist in the up-grading of alumni and/or to help each alumnus attain a position yielding a maximum of satisfaction and happiness.

3. To assist industry in the increasingly difficult job of locating trained and experienced personnel.

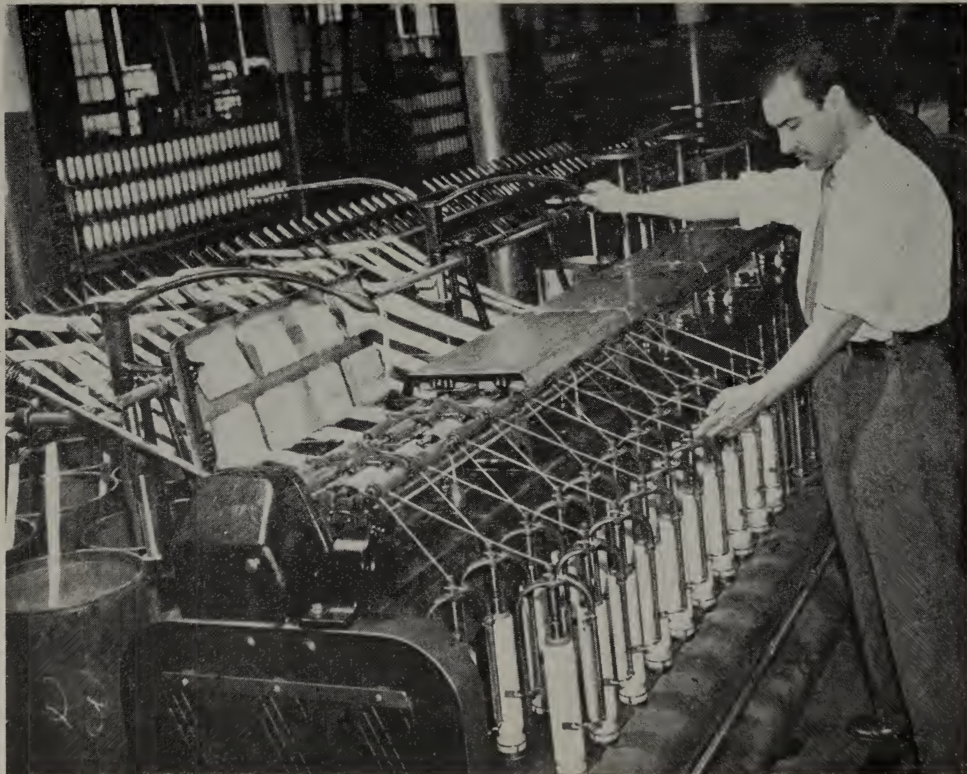
The Placement Office is concerned solely with positions affecting the graduating student; it does not attempt to place undergraduates in part-time or summer employment.

THE CO-OPERATIVE EDUCATION PLAN

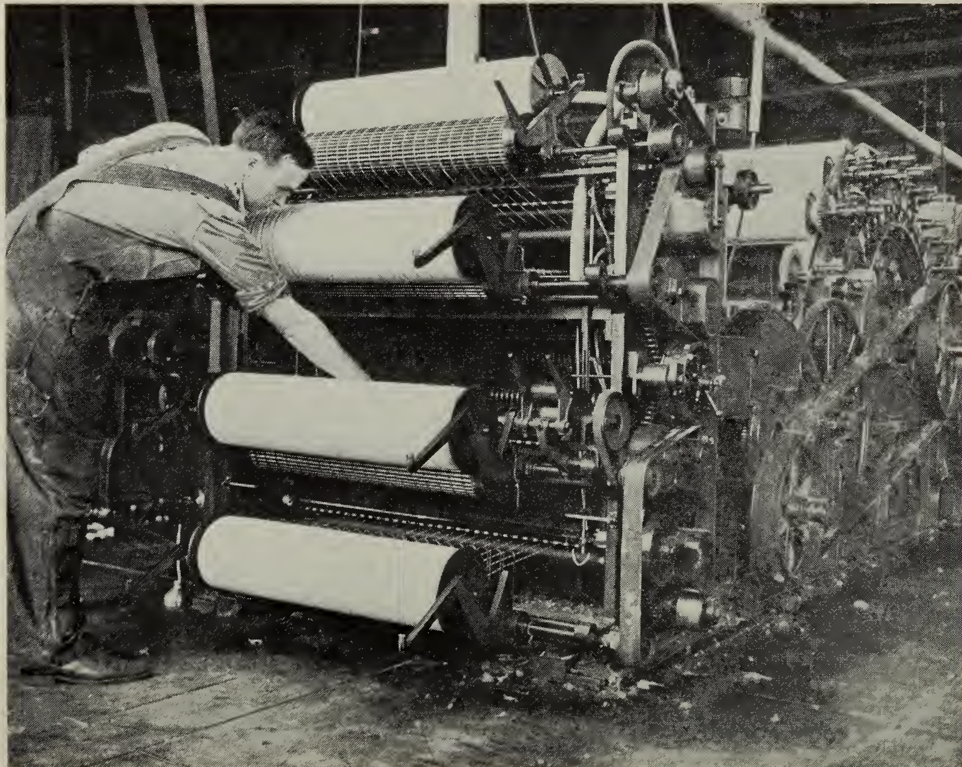
In 1948, Lowell Textile Institute formally adopted the Co-operative Plan of Education, on a voluntary basis, wherein those students electing the plan, and who pass the competitive selection process successfully, spend three summers in the textile industry on a planned work-study basis.

Work opportunities are available to a limited number of students, beginning at the end of the freshman year and continuing each summer thereafter until graduation. It is the hope of this program to give to participating students certain educational experiences that cannot be obtained in school and yet which are vital to the background of the technically trained college graduate, such as contact with machines and people in a production environment; development of an awareness of jobs and the impact of mass production methods on the personality of labor; knowledge of the interplay of the different fields of study covered in school in the successful operation of business. It is also hoped that by working in the industry early enough in his career, the student can judge more clearly and more thoughtfully whether or not he has been wise in choosing a textile career.

The manner in which the plan operates is fully described in a separate bulletin, which is available on request.



SUPERDRAFT ROVING FRAME



WOOLEN CARD

COURSES FOR THE BACHELOR OF SCIENCE DEGREE

Lowell Textile Institute offers eight curricula options, all leading toward the B.S. degree. A student chooses the desired option at the conclusion of the first semester of the freshman year and begins to specialize during the second semester of the freshman year. All curricula are sufficiently broad in educational scope during the first two years to permit a student to alter his initial choice of curriculum with a minimum of lost time, should a new objective become desirable.

A detailed program of the instruction included in each curriculum is given in the form of tabular outlines, showing for each semester all courses required, the number of semester credit hours assigned to each course (a semester credit hour represents one hour of lecture or 2-3 hours of laboratory each week for a minimum term of sixteen weeks), and the total number of contact hours in class each week. A more detailed description of each course offered at Lowell Textile Institute may be found in the section of this Bulletin entitled "COURSE DESCRIPTIONS," wherein the courses are listed alphabetically and may be found by referring to the same course number designations shown in the tables below.

First Year. First Semester (Common to All Courses)

			Credit Hours
Chem.	101	General Inorganic Chemistry	5
Math.	101	Mathematics	4
Engl.	101	English Composition and Literature	3
Phys.	101	Physics	4½
Eng.	111	Engineering Drawing	2
Tex.	101	Survey of Textiles	1
		Physical Education	0
		Credit Hour Total	19½
		Contact Hour Total	28

COURSE I. — COTTON MANUFACTURE

The Cotton Manufacturing curriculum is intended for students contemplating a career in the manufacture of cotton textiles or of textiles produced from any staple fiber utilizing the cotton system of fiber manipulation.

Since cotton itself is the most important textile fiber in terms of domestic and world-wide consumption, it is the policy of this course first to give the student a thorough course of instruction in handling cotton. Later, the adaptation of cotton machinery to handle rayon, wool, and other staple fibers is considered. Further, the student is given some orientation to other basic manufacturing systems (wool, filament) in order to develop a well-rounded textile viewpoint.

Around the core of manufacturing subjects there is built an educational background in engineering, science, liberal arts, and business administration aimed at giving the student a broad, versatile basis for assuming his responsibilities in industry and society.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Math.	102	Mathematics	4
Engl.	102	English Composition and Literature	3
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Tex.	102	Introduction to Fibers	2
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Cotton	201–202	Cotton Carding	5	5
Cotton	211	Cottons	1½	–
Cotton	222	Cotton Waste Processing	–	1½
Des.	101	Textile Design	3	–
Des.	222	Textile Design	–	2
Weav.	211–212	Weaving	2½	2½
Des.	262	Color	–	1
Tex.	241	Library	1	–
Engl.	222	Appreciation of Literature		
or		or	–	3
Soc. Sci.	212	World History		
		Credit Hour Total	21	19
		Contact Hour Total	29	28

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Cotton	301	Spinning	4	–
Cotton	302	Winding and Twisting	–	5
Cotton	311	Staple Fiber Manufacture	1½	–
Cotton	322	Quality Control	–	1
Wool	311–312	Survey of Wool Manufacture	2	2
Des.	223	Textile Design	2	–
Weav.	311–312	Weaving	2½	2½
Tex.	311–312	Textile Testing	3	3
Chem.	221–222	Textile Chemistry	2	2
Eco.	201–202	Economics	3	3
		Credit Hour Total	20	18½
		Contact Hour Total	28	32

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Cotton	401	Mill Organization	4	–
Cotton	402	Management Problems	–	2
Finish.	421–422	Cotton Finishing	3	3
Knit.	401	Knitting	4	–
Eco.	351	Textile Marketing	2	–
Eco.	412	Business Administration	–	4
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Syn.	322	Filament Processing Survey	–	2
Elective			3–4	2–3
		Credit Hour Total	19–20	19–20
		Contact Hour Total	21–30	19–30

COURSE II — WOOL MANUFACTURE

The option in Wool Manufacturing is arranged for students who contemplate a career in those industries utilizing the wool fiber or using the woolen and/or worsted system of machinery to process staple fibers of any type.

As with the Cotton Manufacturing program, the student is oriented to all fibers and to all basic processing systems; but, in this case, primary emphasis is given to the wool fiber. The educational philosophy behind Course II is identical to that described for Course I, and every effort is made to give the student a versatile educational background without losing sight of his vocational goal.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Math.	102	Mathematics	4
Engl.	102	English Composition and Literature	3
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Tex.	102	Introduction to Fibers	2
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Wool	201–202	Fiber Preparation	2	2
Wool	211–212	Top Making	4	4
Des.	101	Textile Design	3	–
Des.	232	Textile Design	–	2
Weav.	211–212	Weaving	2½	2½
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Tex.	241	Library	1	–
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	–	3
Eng.	212	Heat and Power	–	3
		Credit Hour Total	20½	20½
		Contact Hour Total	29	30

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Wool	301–302	Woolen Yarns	2	3
Wool	321–322	Worsted Yarns	4	5
Weav.	311–312	Weaving	2½	2½
Eco.	351	Textile Marketing	2	–
Des.	233	Design	2	–
Chem.	221–222	Textile Chemistry	2	2
Cotton	331–332	Survey of Cotton Manufacturing	2	2
Eco.	201–202	Economics	3	3
Des.	272	Color	–	1
Tex.	302	Properties and Application of Fabrics	–	2
		Credit Hour Total	19½	20½
		Contact Hour Total	27	31

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Tex.	311–312	Textile Testing	3	3
Eng.	422	Textile Process Instrumentation	–	2
Syn.	322	Filament Processing Survey	–	2
Knit.	401	Knitting	4	–
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Fin.	401–402	Wool and Worsted Finishing	3	3
Eco.	341	Textile Costing	3	–
Eco.	412	Business Administration	–	4
Wool	411	Wool Mill Organization	4	–
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	20	20
		Contact Hour Total	26	23

COURSE III — TEXTILE DESIGN

The Textile Design course is especially intended to equip students for a career in the field of textile designing and styling. Full opportunity is given for the development of creative ideas with an extensive background of essential scientific and practical manufacturing training, integrated to a basic core of courses in the liberal arts, economics, and business administration.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	104	Mechanism	2
Engl.	102	English Composition and Literature	3
Math.	102	Mathematics	4
Tex.	102	Introduction to Fibers	2
Des.	102	Elementary Textile Design	3
Des	112	Handloom Weaving	1
Des.	122	Perspective	1
Des.	132	Freehand Drawing	1
		Physical Education	0
		Credit Hour Total	21
		Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Des.	203–204	Textile Design — Cotton and Synthetics	2½	2½
Des.	211–212	Textile Design — Wool and Worsted	2½	2½
Des.	242	Decorative Design	–	1
Des.	251–252	Color	2	2
Weav.	201–202	Weaving	3	3
Tex.	241	Library	1	–
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Chem.	221–222	Textile Chemistry	2	2
Engl.	222	Appreciation of Literature or	–	3
Soc. Sci.	212	World History		
		Credit Hour Total	21	20
		Contact Hour Total	28	30

Third Year

			Credit Hours First Semester	Credit Hours Second Semester
Des.	301–302	Textile Design — Cotton and Synthetics	2½	2½
Des.	311–312	Textile Design — Wool and Worsted	2½	2½
Weav.	301–302	Weaving	3	3
Cotton	331–332	Survey of Cotton Manufacture	2	2
Wool	311–312	Survey of Wool Manufacture	2	2
Syn.	322	Survey of Filament Processing	–	2
Eco.	351	Textile Marketing	2	–
Tex.	302	Application and Properties of Fabrics	–	2
Eco.	201–202	Economics	3	3
Eco.	341	Textile Costing	3	–
		Credit Hour Total	20	19
		Contact Hour Total	28	27

Fourth Year

			Credit Hours First Semester	Credit Hours Second Semester
Des.	401	Textile Design — Wool and Worsted	2	–
Des.	402	Textile Design — Cotton and Synthetics	–	2
Des.	411–412	Jacquard Design and Weaving	2	2
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
Knit.	403	Knitting	3	–
Eco.	412	Business Administration	–	4
Fin.	412	Wool and Worsted Finishing	–	4
Fin.	431	Cotton and Rayon Finishing	4	–
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Tex.	311–312	Textile Testing	3	3
Elective			3	–
		Credit Hour Total	20	21
		Contact Hour Total	24–30	25

COURSE IV — CHEMISTRY AND TEXTILE COLORING

This curriculum is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

Therefore, the student is given a broad background in basic chemistry, coordinated with an understanding of textile fibers and their manipulation into yarn and fabric and subsequent physical and chemical modification. Taken together with a core of liberal arts and economic subjects, this program provides a diversified training to match the inherent complexity of the textile chemistry field and the society of which it is a part. Furthermore, since many majors in textile chemistry plan graduate study, the curriculum is in part designed to give such students adequate background for this advanced study.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Chem.	122	Qualitative Analysis	4
Chem.	124	Stoichiometry	2
Math.	102	Mathematics	4
Tex.	102	Introduction to Fibers	2
Engl.	102	English Composition and Literature	3
Eng.	104	Mechanism	2
		Physical Education	0
		Credit Hour Total	21
		Contact Hour Total	31

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Chem.	201–202	Organic Chemistry	4	4
Chem.	211–212	Quantitative Analysis	3	3
Chem.	231	Library	1	–
Chem.	241–242	Stoichiometry	1	1
Phys.	201–202	Physics	4	4
Math.	203	Mathematics	4	–
Math.	204	Mathematics in Chemistry	–	2
Tex.	201–202	Textile Manufacturing	3	3
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	20	20
		Contact Hour Total	29	29

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Chem.	321–322	Textile Chemistry . . .	3	3
Chem.	331–332	Physical Chemistry . . .	3½	4
Chem.	341	Textile Quantitative Analysis .	3	–
Eco.	201–202	Economics	3	3
Des.	101	Textile Design and Cloth Construction	3	–
Tex.	302	Application and Properties of Fabric	–	2
Tex.	311–312	Textile Testing	3	3
Restricted Electives*				
Chem.	352	Chemical Engineering		
or		or	–	2–3
Ger.	302	Scientific German		
Eng.	351	Statistics		
or		or	3	–
Ger.	301	Scientific German		
Chem.	312	Textile Quantitative Analysis		
or		or	–	3
Chem.	342	Organic Qualitative		
		Credit Hour Total . .	21½	20–21
		Contact Hour Total .	29	27–28

* If German is elected during the first semester, it must be continued throughout the year.

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Chem.	411–412	Textile Chemistry and Dyeing .	5	5
Chem.	421	Advanced Chemical Testing .	3	–
Chem.	431	Colloid Chemistry . . .	3	–
Soc. Sci.	301	Industry and Society . . .	3	–
Soc. Sci.	302	Modern Labor Problems . .	–	3
Eco.	351	Textile Marketing . . .	2	–
Fin.	431	Cotton and Rayon Finishing .	4	–
Fin.	412	Wool and Worsted Finishing .	–	4
Restricted Electives				
Chem.	313	Textile Quantitative Analysis	3	
Chem.	441	Advanced Chemical Engineering		
Chem.	451	Natural High Polymers		
Chem.	461	Microbiology		
Chem.	471	Advanced General Chemistry		
Chem.	481	Senior Thesis*		
Chem.	491	Advanced Chemical Microscopy		
Eco.	412	Business Administration		4
or		or		
Eco.	344	Principles of Selling and Advertising		
Chem.	432	Applied Colloid Chemistry		3
Chem.	452	Synthetic High Polymers		
Chem.	462	Microbiology		
Chem.	474	Advanced Dyeing		
Chem.	482	Senior Thesis		
Chem.	484	Textile Chemistry Seminar		
Free Electives		. . . .	–	3
		Credit Hour Total . .	23	22
		Contact Hour Total	. Maximum of 34	

* If Senior Thesis is elected, it must be taken both semesters.

COURSE V — SYNTHETIC TEXTILES

This curriculum is designed for those students interested in any segment of the textile industry primarily devoted to the utilization of synthetic fibers, with particular emphasis on continuous filament textiles.

The synthetic fiber phase of textiles is the most recent addition to the field and may be said to be the only section of the industry created wholly in the chemical research laboratories of the country. As such, an understanding of the utility of synthetic fibers depends upon a sound training in chemistry, physics, and mathematics and a thorough awareness of the chemical and physical properties of synthetics which limit their use, in pure form or in blends. COURSE V, therefore, will be found to be a compromise between the manufacturing courses (I, II) and the chemistry course (IV) and it is hoped that majors in this program will be equally acceptable to the textile manufacturer, the synthetic fiber producer, or the graduate schools of the country.

FIRST YEAR. SECOND SEMESTER

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Math.	102	Mathematics	4
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Tex.	102	Introduction to Fibers	2
Engl.	102	English Composition and Literature	3
Syn.	102	Orientation in Synthetic Textiles	½
		Physical Education	0
		Credit Hour Total	20½
		Contact Hour Total	29

SECOND YEAR

			Credit Hours First Semester	Credit Hours Second Semester
Math.	203	Mathematics	4	–
Phys.	201–202	Physics	4	4
Chem.	201–202	Organic Chemistry	3	3
Tex.	201–202	Textile Manufacturing	3	3
Des.	101	Textile Design	3	–
Des.	222	Textile Design	–	2
Eco.	201–202	Economics	3	3
Tex.	241	Library	1	–
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
Engl.	222	Appreciation of Literature or		3
Soc. Sci.	212	World History		
		Credit Hour Total	21	21
		Contact Hour Total	29	28

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Syn.	301	Filament Yarn Processing	2	–
Syn.	302	Throwing Plant Organization	–	2
Syn.	331–332	Filament Yarn Laboratory	1	1
Syn.	311–312	Synthetic Fibers	3	3
Tex.	311–312	Textile Testing	3	3
Tex.	302	Application & Properties of Fabrics	–	2
Des.	401	Textile Design	2	–
Weav.	211–212	Weaving	2½	2½
Chem.	221–222	Textile Chemistry	2	2
Eco.	351	Textile Marketing	2	–
Soc. Sci.	221	Industrial History	3	–
Soc. Sci.	402	Industrial Relations Seminar	–	2
Eco.	412	Business Administration	–	4
		Credit Hour Total	20½	21½
		Contact Hour Total	25	28

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Syn.	411–412	Synthetic Fibers	3	3
Syn.	452	Synthetic Fiber Seminar	–	2
Eng.	351	Statistics	3	–
Weav.	311–312	Weaving	2½	2½
Knit.	401	Knitting	4	–
Fin.	432	Cotton & Synthetic Finishing	–	4
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
		Free Electives	5	5
		Credit Hour Total	20½	19½
		Contact Hour Total	30	29

COURSE VI — TEXTILE ENGINEERING

Two options are offered in Textile Engineering, *viz.*, General Manufacturing and Engineering. It is the basic belief of the faculty and administration at Lowell Textile Institute that except in certain highly specialized areas, *e.g.*, chemistry, the ideal training for the textile industry and for efficient, intelligent citizenship combines an understanding of textile processing relating to all fibers, a sound engineering and scientific background, and an orientation to society and business through a selected core of liberal arts and economic courses. Although the credit hour ratings assigned to VI-G and VI-E are somewhat above the average, experience has shown that they are within the capacity of the student of serious intent who really desires the broad training they provide.

GENERAL MANUFACTURING OPTION — VI-G

The General Manufacturing Option is designed for the man who wishes a thorough preparation in the manufacturing and processing of all textile fibers. This practical textile training is combined with a background in basic engineering subjects to fit the student to meet the demand of the textile and allied industries for men with a combined textile and technical preparation.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	122	Machine Tool Laboratory	1
Engl.	102	English Composition and Literature	3
Tex.	102	Introduction to Fibers	2
Math.	102	Mathematics	4
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Math.	201–202	Mathematics	3	3
Phys.	201–202	Physics	4	4
Chem.	221–222	Textile Chemistry	2	2
Des.	101	Textile Design	3	–
Des.	224	Textile Design — Cotton and		
Des.	234	Synthetics	–	2
		Textile Design — Wool and		
Weav.	221–222	Worsted	–	2
		Weaving	2	2
Cot.	203–204	Cotton Carding	4	4
Wool	213–214	Fiber Preparation	1½	1½
Wool	215–216	Top Making	2½	2½
		Credit Hour Total	22	23
		Contact Hour Total	26	30

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Eco.	201–202	Economics	3	3
Tex.	311–312	Textile Testing	3	3
Phys.	321	Electronics	3½	–
Eng.	321	Strength of Materials	3	–
Eng.	344	Electrical Machinery	–	4
Cot.	303	Cotton Spinning	3	–
Cot.	304	Cotton Winding and Twisting	–	3
Syn.	322	Filament Processing Survey	–	1
Wool	323–324	Woolen Yarns	1½	2½
		Worsted Yarns	3½	3½
Weav.	321–322	Weaving	2	2
Tex.	241	Library	1	–
		Credit Hour Total	23½	22
		Contact Hour Total	27	27

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Fin.	431	Cotton and Rayon Finishing	4	–
Fin.	412	Wool and Worsted Finishing	–	4
Eng.	311	Heat Engineering	4	–
Eng.	402	Textile Applications of Electricity	–	1
Eng.	422	Textile Process Instrumentation	–	2
Cot.	401	Mill Organization	4	–
Knit	404	Knitting	–	3
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Tex.	302	Properties and Applications of Fabrics	–	2
Eco.	341	Textile Costing	3	–
Eco.	351	Textile Marketing	2	–
Eco.	412	Business Administration	–	4
Eng. or Phys.	431 or 401	Advanced Physical Testing or Advanced Textile Microscopy	2	–
Engl.	202	Speech	–	2
Engl.	212	Business English	–	1
		Credit Hour Total	22	22
		Contact Hour Total	27	28

ENGINEERING OPTION — VI-E

This option is designed to give the student a thorough preparation in the fundamental principles of mechanical engineering with specialization in the engineering problems arising out of textile manufacturing in all its branches. It emphasizes basic engineering rather than the details of textile processing and should equip the student with the necessary background to enter any branch of the textile or allied industries in an engineering capacity.

First Year. Second Semester

			Credit Hours
Chem.	102	General Inorganic Chemistry	4
Eng.	102	Mechanism	4
Eng.	112	Engineering Drawing	2
Eng.	232	Machine Tool Laboratory	1
Engl.	102	English Composition and Literature	3
Tex.	102	Introduction to Fibers	2
Math.	102	Mathematics	4
		Physical Education	0
		Credit Hour Total	20
		Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Eng.	201	Machine Drawing	1	–
Eng.	221	Textile Mechanism	1½	–
Eng.	222	Applied Mechanics	–	3
Eng.	233	Machine Tool Laboratory	-	–
Math.	201-202	Mathematics	3	3
Phys.	201–202	Physics	4	4
Tex.	201–202	Textile Manufacturing	3	3
Des.	101	Elementary Textile Design	3	–
Des.	224	Textile Design — Cotton and Synthetic	–	2
Des.	234	Textile Design — Wool and Worsted	–	2
Weav.	221–222	Weaving	2	2
Engl.	201	Speech	2	–
Tex.	241	Library	1	–
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History		
		Credit Hour Total	21½	22
		Contact Hour Total	31	27

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Eng.	301–302	Advanced Applied Mechanics	3	3
Eng.	312	Heat Engineering	–	4
Eng.	331	Mill Engineering	3	–
Eng.	342	Electrical Machinery	–	4
Eng.	351	Statistics	3	–
Eco.	201–202	Economics	3	3
Engl.	212	Business English	–	1
Tex.	302	Application and Properties of Fabrics	–	2
Tex.	311–312	Textile Testing	3	3
Weav.	321–322	Weaving	2	2
Phys.	321	Electronics	3½	–
		Credit Hour Total	20½	22
		Contact Hour Total	22	25

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Eng.	401	Electrical Engineering	4	–
Eng.	402	Textile Applications of Electricity	–	1
Eng.	411	Advanced Heat Engineering	3	–
Eng.	422	Textile Process Instrumentation	–	2
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Fin.	412	Wool and Worsted Finishing	–	4
Fin.	431	Cotton and Rayon Finishing	4	–
Knit.	404	Knitting	–	3
Eco.	341	Textile Costing	3	–
Eco.	412	Business Administration	–	4
Tex.	431	Fabric Development	2	–
Eng.	431	Advanced Physical Testing		
or		or	2	–
Phys.	401	Advanced Textile Microscopy		
Phys.	402	Advanced Textile Physics		
or		or	–	3
Eng.	424	Machine Design		
		Credit Hour Total	21	20
		Contact Hour Total	27	29

COURSE VII — TEXTILE SALES

This option is designed for those interested in the distribution, marketing, and sales of textile products. An attempt is made to give the student not only training in the fundamental principles of sales, advertising, and the economic factors influencing the market, but also to prepare a broad scientific and manufacturing background, so necessary to an intelligent awareness of the utility of the myriad of textile products.

First Year. Second Semester

		Credit Hours
Chem. 102	General Inorganic Chemistry	4
Eng. 102	Mechanism	4
Eng. 112	Engineering Drawing	2
Eng. 122	Machine Tool Laboratory	1
Engl. 102	English Composition and Literature	3
Tex. 102	Introduction to Fibers	2
Math. 102	Mathematics	4
	Physical Education	0
	Credit Hour Total	20
	Contact Hour Total	30

Second Year

			Credit Hours First Semester	Credit Hours Second Semester
Math.	203	Mathematics	4	–
Tex.	241	Library	1	–
Phys.	201–202	Physics	4	4
Cot.	331–332	Cotton Manufacturing Survey	2	2
Wool	311–312	Wool Manufacturing Survey	2	2
Syn.	322	Filament Processing Survey	–	2
Des.	101	Textile Design	3	–
Des.	222	Textile Design — Cotton and Synthetics	–	2
Weav.	211–212	Weaving	2½	2½
Chem.	221–222	Textile Chemistry	2	2
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	–	3
		Credit Hour Total	20½	19½
		Contact Hour Total	26	26

		Third Year	Credit Hours First Semester	Credit Hours Second Semester
Eco.	201–202	Economics	3	3
Eco.	311	Statistics	3	–
Eco.	321	Principles of Marketing	3	–
Eco.	322	Marketing Methods	–	4
Eco.	344	Principles of Selling and Advertising	–	4
Tex.	311–312	Textile Testing	3	3
Des.	223	Textile Design — Cotton and Synthetics	2	–
Des.	232	Textile Design — Wool and Worsted	–	2
Des.	251–252	Color	2	2
Weav.	311–312	Weaving	2½	2½
Engl.	201	Speech	2	–
Engl.	212	Business English	–	1
		Credit Hour Total	20½	21½
		Contact Hour Total	24	25

		Fourth Year	Credit Hours First Semester	Credit Hours Second Semester
Eco.	340	Accounting	3	–
Eco.	412	Industrial Management	–	4
Eco.	421	Foreign Trade	3	–
Eco.	431–432	Selling Policies	3	3
Fin.	412	Wool and Worsted Finishing	–	4
Fin.	431	Cotton and Rayon Finishing	4	–
Tex.	302	Properties and Application of Fabrics	–	2
Soc. Sci.	301	Industry and Society	3	–
Soc. Sci.	302	Modern Labor Problems	–	3
Des.	233	Textile Design — Wool and Worsted	2	–
Electives			2–3	3–4
		Credit Hour Total	20–21	19–20
		Contact Hour Total	23–30	22–30

COURSE DESCRIPTIONS

1. First semester courses are indicated by odd numbers.
2. Second semester courses are indicated by even numbers.
3. Courses conducted for a full year are indicated by double numbers, and the credit hours shown are for the entire year.
4. Each course is listed with the number of lecture and laboratory hours, and the number of credit hours carried by the course. Prerequisite subjects, if required, are noted with each description.
5. Admission to any course without the prerequisite requirements must be obtained from the Head of the Department concerned.

   Courses numbered 100–199 are normally given at the freshman level.

   Courses numbered 200–299 are normally given in the second year.

   Courses numbered 300–399 are normally given in the third year.

   Courses numbered 400–499 are normally given in the fourth year.

   Courses numbered 500 and above are restricted to graduate students.

Courses Are Listed Alphabetically by Subject Classifcations, Irrespective of the Department Involved.

CHEMISTRY

Chem. 101–102 GENERAL INORGANIC CHEMISTRY 9 Credit Hours

Three lectures and one recitation period per week, first semester

Three lectures per week, second semester

One three-hour laboratory period per week, both semesters

The first semester is concerned with the basic principals of chemistry and a consideration of non-metallic elements and their compounds. In the second semester, attention is focussed on metals and their compounds, and the basis is laid for qualitative analysis.

Chem. 114 ELEMENTARY ORGANIC CHEMISTRY

Three lectures per week 3 Credit Hours

Prerequisite: Chem. 101

This courses is designed for those not planning to continue in chemistry and considers broadly the basic principles of organic chemistry.

Chem. 122 QUALITATIVE ANALYSIS 4 Credit Hours

One lecture and one recitation period per week

Two four-hour laboratory periods per week

Prerequisite: Chem. 101

The course covers the systematic qualitative analysis of inorganic compounds. Some emphasis is placed on textile applications in the designed of laboratory experiments.

Chem. 124 STOICHIOMETRY 2 Credit Hours

Two hours per week

Prerequisites: Chem. 101, Math. 101

The elementary calculations of inorganic chemistry and quantitative analysis.

X-RAY DIFFRACTION UNIT

Used in Graduate Courses and in Research in Fiber Structure

RECORDING SPECTROPHOTOMETER

Used in Graduate Courses and in Research for Color Measurement, Identification and Evaluation

CHEM. 201–202 GENERAL ORGANIC CHEMISTRY 8 CREDIT HOURS
Three lectures per week
One three-hour laboratory period per week
Prerequisite: CHEM. 102

A study of the important classes of carbon compounds and the fundamental theories of organic chemistry.

CHEM. 211–212 QUANTITATIVE ANALYSIS 6 CREDIT HOURS
One lecture per week
Two three-hour laboratory periods per week
Prerequisite: CHEM. 122

This course covers the fundamental principles of quantitative analysis. The first semester emphasizes gravimetric of analysis. Volumetric techniques are covered during the second semester.

CHEM. 221 TEXTILE CHEMISTRY 2 CREDIT HOURS
Two lectures per week
Prerequisite: CHEM. 102

This course is designed for those not planning to continue in chemistry and consist of a series of lectures covering the various processes preliminary to dyeing, dyeing methods, and basic information on dyes and other textile chemicals of significance to these processes.

CHEM. 222 TEXTILE CHEMISTRY 2 CREDIT HOURS
One lecture per week
One three-hour laboratory period per week
Prerequisite: CHEM. 221

Second semester continuation of CHEM. 221, but not required of all students taking CHEM. 221.

CHEM. 231 LIBRARY 1 CREDIT HOUR
One lecture per week
Prerequisite: CHEM. 102

Lectures on the use of the literature and the methods of library classification with particular emphasis on the use of chemical and textile literature.

CHEM. 241–242 STOICHIOMETRY 2 CREDIT HOURS
One recitation per week
Prerequisite: CHEM. 124

Calculations of grarimetric analysis, are studied in the first semester; calculation of volumetric analysis, in the second semester.

CHEM. 311 TEXTILE QUANTITATIVE ANALYSIS
One lecture per week 3 CREDIT HOURS
Two three-hour laboratory periods per week
Prerequisite: CHEM. 212

This course is devoted to basic principles of chemical analysis covered in CHEM. 122 and 211–212 and to the examination of materials used in the textile mill, the dye house, and the finishing plant. Among the materials covered are water, oils, soaps, bleaching agents, etc.

CHEM. 312 or 313 TEXTILE QUANTITATIVE ANALYSIS 2 CREDIT HOURS

One lecture per week

One three-hour laboratory period per week

Prerequisite: CHEM. 311

This is a continuation of CHEM. 311. This comprises analysis of textile materials not covered in CHEM. 311.

CHEM. 321–322 TEXTILE CHEMISTRY 6 CREDIT HOURS

Two lectures per week

One three-hour laboratory period per week

Prerequisites: CHEM. 202
PHYS. 102 and ENG. 103

This course is designed primarily for those majoring in chemistry and is the first of four semesters relating to the chemistry of all types of textile fibers, *i.e.,* cotton, wool, rayon, nylon, flax, etc. Among the major topics covered the first year are: (1) Operations preliminary to dyeing, (2) Water in the textile industry, (3) Theory of dyeing, (4) Coloring matters, *i.e.,* natural and synthetic organic coloring matters, mineral coloring matter, (5) Dyeing processes.

CHEM. 331 PHYSICAL CHEMISTRY 3½ CREDIT HOURS

Three lectures per week

One three-hour laboratory period every other week

Prerequisites: CHEM. 102, MATH 203 *or* MATH. 204,
PHYS. 202

First of two semesters of a study of the important principles of physical chemistry, *i.e.,* gaseous, liquid, solid states; elementary chemical thermodynamics; determination of molecular weights; viscosity; surface tension; etc.

CHEM. 332 PHYSICAL CHEMISTRY 4 CREDIT HOURS

Two lectures and one recitation per week

One three-hour laboratory period per week

Prerequisite: CHEM. 331

Second semester continuation of CHEM. 331.

CHEM. 342 ORGANIC QUALITATIVE ANALYSIS 2 CREDIT HOURS

One lecture per week

One three-hour laboratory period per week

Prerequisites: CHEM. 122, 202

The purpose of this course is to acquaint the student with the methods of the qualitative determination of unknown organic compounds.

CHEM. 352 CHEMICAL ENGINEERING 2 CREDIT HOURS

Two lectures per week

Prerequisites: CHEM. 102, MATH. 203 or 204, PHYS. 202

Descriptive and quantitative information on unit conversion, dimensional analysis, materials of construction, flow of fluids, flow of heat, hygrometry, humidification, dehumidification, and drying, with special emphasis on textile application and textile chemical machinery.

CHEM. 411–412 ADVANCED TEXTILE CHEMISTRY AND DYEING 10 CREDIT HOURS

Two lectures per week

Three three-hour laboratory periods per week

Prerequisite: CHEM. 322

Continuation of CHEM. 321–322, covering (1) Color matching and color combining, (2) Dye testing and evaluation, (3) Union dyeing, (4) Printing, (5) Chemistry of textile finishing, (6) Dye house and finishing plant management.

CHEM. 414 SPECIAL STUDIES IN DYEING 3 CREDIT HOURS

One lecture per week

Two three-hour laboratory periods per week

A course designed fo rthose desiring more than the required work in dye application. Further work in dye application is given, also dye testing, color matching and textile printing.

It the student has a particular problem in the application of dyes, time will be allotted for its study.

CHEM. 421 ADVANCED CHEMICAL TEXTILE TESTING

Two lectures per week 3 CREDIT HOURS

One three-hour laboratory period per week

Prerequisite: TEX. 311–312

A series of lectures and laboratory periods designed to supplement the textile testing given in TEX. 311–312. The quantitative as well as the qualitative aspects of the determination of extraneous matter, textile finishing agents, fiber content and fiber damage is followed by some dyestuff identification and evaluation for fastness. The use of optical equipment such as the colorimeter, tintometer, pH apparatus, spectroscope, spectrophotometer, ultra violet radiation and infrared radiation is also taken up.

A course covering the basic properties of colloidal materials and the application of these principles to an understanding of the behavior of textile fibers.

CHEM. 431 COLLOID CHEMISTRY 3 CREDIT HOURS

Three lectures per week

Prerequisite: CHEM. 332

A course covering the basic properties of colloidal materials and the application of these principles to an understanding of the behavior of textile fibers.

CHEM. 432 APPLIED COLLOID CHEMISTRY 2 CREDIT HOURS

One lecture per week

One three-hour laboratory period per week

Prerequisite: CHEM. 431

A continuation of CHEM. 431, but not required of those taking CHEM. 431, which further explores the application of the concepts of colloidal chemistry to textile problems and gives laboratory experience in the techniques for evaluating colloidal phenomena.

CHEM. 441 ADVANCED CHEMICAL ENGINEERING

Three lectures per week 3 CREDIT HOURS

Prerequisite: CHEM. 352

An advanced study of the subjects covered in CHEM. 352, and, in addition, further work in thermodynamics, mechanical mixtures, heat engines, etc. This course is an elective continuation of CHEM. 352.

Chem. 451 NATURAL HIGH POLYMERS 3 Credit Hours

Three lectures per week

Prerequisites: Phys. 202, Chem. 202, 332, Math. 204

The chemistry and physics of natural cellulosic and protein fibers are presented in relation to (1) occurrence, (2) chemical structure, (3) molecular weight and polymolecularity, (4) orientation and fine structure, (5) physical structure, and (6) the effect of these factors on chemical, physical, and mechanical properties. An attempt is made to correlate the material so that an integrated understanding of the behavior of these polymers in textile materials is developed.

Chem. 452 SYNTHETIC HIGH POLYMERS 3 Credit Hours

Three lectures per week

Prerequisites: Phys. 202, Chem. 202, 332, Math. 204

The synthetic high polymers of interest in textile applications will be discussed from the following standpoints: (1) Type of polymerization, (2) Theories of polymer formation, (3) Physical and colloid chemistry of high polymers, (4) Molecular weight, molecular weight distribution, methods of estimating molecular weight, (5) Orientation, and (6) Physical and chemical phenomena. A critical approach is made to the evaluation of the usefulness of synthetic high polymers in textile applications.

Chem. 461 MICROBIOLOGY 2 Credit Hours

One lecture per week

One two-hour laboratory period per week

Prerequisite: Chem. 202

The course considers the fundamentals of mycological and bacteriological theory briefly but in sufficient detail so that the problem of the microbiological deterioration of textiles may be discussed.

Methods of detecting mildewing, and methods of testing textiles for mildew resistance are considered in the laboratory.

Chem. 462 MICROBIOLOGY 1 Credit Hour

One three-hour laboratory period per week

Prerequisite: Chem. 461

The work is arranged according to the interests of the individual student. Laboratory exercises such as the identification of pure cultures, the comparison of commercial mildewproofing agents, etc., are typical.

Chem. 471 ADVANCED GENERAL CHEMISTRY 2 Credit Hours

Two lectures per week

Prerequisite: Chem. 332

This course introduces the student to theories which are important in present-day chemistry. In addition, an attempt is made to augment the knowledge in order to broaden and deepen the understanding of many phases of chemistry. In this course, such topics as the hydrogen bond, Werner's co-ordination theory, theories of acids and bases, particles of modern physics, and the quantum theory are discussed.

Chem. 472 INORGANIC PREPARATIONS 3 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisite: Chem. 102

The purpose of the course is to familiarize the student with those reactions and processes of inorganic chemistry which are more used in commercial practice than in the laboratory. Experiments are chosen in conference between student and instructor.

Chem. 474 ADVANCED DYEING 3 Credit Hours

One lecture per week

Two three-hour laboratory periods per week

Prerequisite: Chem. 411

This elective course is designed for those students with a special area of interest in dyeing and permits individual experimental study with materials selected by the student in conference with the instructor.

Chem. 481–482 SENIOR THESIS

Hours to be arranged. Topic selected in conference with major professor.

Chem. 483–484 TEXTILE CHEMISTRY SEMINAR 4 Credit Hours

Two hours per week

Prerequisite: Seniors and Graduate Students in Chemistry only.

A series of informal discussions of current problems in research and technology in the textile chemistry field. Special investigations of the literature will be utilized to serve as a source of seminar topics.

Chem. 485 or 486 GLASS BLOWING 1 Credit Hour

Three hours of laboratory per week

A practical course designed to give the student an ability to construct and repair apparatus in the chemical or physical laboratory. The standard techniques in soda and pyrex glass are practiced. Included are — straight seals, T seals, inner seals, reduction tubes, capillary tubing, bulbs, flaring, etc., and many combinations of these. Simple metal to glass seals and the ability to handle deKhotinsky cement are also included.

Chem. 491 APPLICATIONS OF MICROSCOPY 2 Credit Hours

One lecture per week

Three hours of laboratory per week

Prerequisite: Tex. 311–312

Lectures and laboratory work on the more advanced aspects of the applications of textile microscopy. Further work on fiber sectioning, fiber casts, and polarized light phenomena is done; also the various quantitative aspects of textile microscopy such as deconvolution count, wool grading, hair identification, and the quantitative analysis of fiber mixtures are considered.

Chem. 501 or 502 APPLICATIONS OF COLOR MEASUREMENT

Hours to be arranged

Prerequisites: Chem. 421 or equivalent

This course covers the application of the recording spectrophotometer with particular emphasis on the interpretation and limitations of the data obtained from each technique. Among the instruments studied are the Tintometer, Colorimeter, and Recording Spectrophotometer.

CHEM. 511 or 512 WETTING AGENTS AND DETERGENTS
Hours to be arranged
Prerequisite: CHEM. 431

A laboratory course, with conferences, on the evaluation of standard wetting agents, detergents, and analogous auxiliaries, with particular emphasis on industrial applications.

CHEM. 521 or 522 TEXTILE TESTING RESEARCH
Hours to be arranged
Prerequisite: CHEM. 421

Special problems relating to the design and evaluation of improved analytical or testing procedures.

CHEM. 523 or 524 GROUP RESEARCH
Hours to be arranged
Limited to 4–6 students

A series of conferences and laboratory periods on the carrying out of a piece of industrial research by the concerted action of a group. The problem is analyzed, its various parts distributed to individuals, and the results combined by the group. The students alternate on supervising the work of the group.

CHEM. 525 or 526 EVALUATION OF HANDLE 1 CREDIT HOUR
Three hours of laboratory per week

A laboratory course designed to teach the use of the various test methods and instruments in evaluating the effect of finishing treatments on the tactile and end-use properties of a fabric.

COTTON

COTTON 201–202 COTTON CARDING 10 CREDIT HOURS
Three lectures per week
Six hours of laboratory per week
Prerequisite: ENG. 102 or ENG. 104

This course relates to the growth, classing, and handling of raw cotton and the processes of opening, picking, carding, combing, drawing, and roving. Considerable time is devoted to the studying of cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. The basis of cotton classing is thoroughly covered here and the general background of how cotton is bought and sold is explained. The mill processes are studied in detail, using specially prepared texts and illustrations. Emphasis is placed on the purposes and principles of each machine rather than on skill of operation.

COTTON 203–204 COTTON CARDING 8 CREDIT HOURS
Three lectures per week
One two-hour laboratory period per week
Prerequisite: ENG. 102 or ENG. 104

This course is similar to COTTON 201–202, but with considerably less laboratory time. The course is designed for those with a more general interest in textile manufacturing.

COTTON 211 COTTONS 1½ CREDIT HOURS

One hour of lecture per week

One hour of laboratory per week

Prerequisites: ENG. 102 *or* 104, COTTON 201 taken simul- *taneously*

This course consists of lectures and laboratory work, supplementary to COTTON 201 for those students who study cotton only. Some time is spent on the details of cotton fiber growth and structure and in comparing cotton with other fibers. The economic importance of cotton is studied and sources of information regarding cotton and its processing are given to the class.

COTTON 222 COTTON WASTE PROCESSING 1½ CREDIT HOURS

One hour of lecture per week

One hour of laboratory per week

Prerequisite: COTTON 201

For those specializing in Cotton Manufacture, this course provides a survey of the methods and machinery used in processing cotton wastes, or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment and the manufacturing processes. Samples of wastes and products are used to demonstrate the possibilities in this field.

COTTON 301 COTTON SPINNING 4 CREDIT HOURS

Two lectures per week

Five hours of laboratory per week

Prerequisite: COTTON 202

This course is a continuation of the study of yarn manufacture and covers the many types of regular and long drafts spinning. Particular consideration is given to the production of yarns for different uses and to methods by which desired characteristics may be obtained. All the calculations regarding yarns and spinning frames are thoroughly studied and problems are assigned for student practice.

COTTON 302 COTTON WINDING AND TWISTING

Two lectures per week 5 CREDIT HOURS

Ten hours of laboratory per week

Prerequisite: COTTON 301

This course is a continuation of the course on spinning, in which the instruction includes the conclusion of spinning, spooling and the various types of winding, the twisting of common and fancy yarns, and such incidental features as reeling baling, mule spinning and rope manufacture. (Some of these items are optional.) All the calculations regarding winders and twisters are thoroughly studied and problems are assigned for student practice.

COTTON 303 COTTON SPINNING 3 CREDIT HOURS

Two lectures per week

One two-hour laboratory period per week

Prerequisite: COTTON 204

This course is similar to COTTON 301, but the time devoted to laboratory practiced is shortened.

Cotton 304 COTTON WINDING AND TWISTING

Two lectures per week 3 Credit Hours

One two-hour laboratory period per week

Prerequisite: Cotton 303

This course is similar to Cotton 302, but the time devoted to laboratory practice is shortened.

Cotton 311 STAPLE FIBER MANUFACTURE 1½ Credit Hours

One lecture per week

One hour of laboratory per week

Prerequisite: Cotton 301

Using the preparatory courses as a background, this course offers a study of the methods of manufacture of various staple fibers, such as wool, rayon, or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the course is planned to take advantage of the new developments as they appear. A considerable amount of the work in this course is of the dicussion type, which aims to correlate all the work on yarn manufacture and to bring it to bear on the processing of staple fibers.

Cotton 322 COTTON QUALITY CONTROL 1Credit Hour

One lecture per week

Prerequisite: Cotton 301

While it is customary to point out defects in the materials during the processing in all the laboratory work, this course provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this course. Every effort is made to develop the diagnostic ability of the student so that he may readily recognize and remedy new defects as he meets them.

Cotton 331–332 COTTON MANUFACTURING SURVEY

Two hours of lecture per week 4 Credit Hours

One hour of laboratory-demonstration per week

For students with but a secondary interest in Cotton Manufacture, this survey course outlines the processes used and the principles in cotton yarn manufacture. The first semester's work considers cotton qualities and production and the processes through combing. The second semester starts with drawing and the material studied includes spinning, winding and twisting.

While this course consists primarily of lectures, it is planned to include some laboratory demonstration. Outside preparation will include some study of the standard manufacturing machinery in the laboratory.

Cotton 401 MILL ORGANIZATION 4 Credit Hours

Four lectures per week

Prerequisite: Cotton 302 or 304

This course correlates all of the work on Cotton Manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and for the handling of staple fibers are carefully covered. Estimates are made of the machinery necessary to keep plants in balance with some consideration of the best arrangements for economical handling.

COTTON 402 MANAGEMENT PROBLEMS 2 CREDIT HOURS

Two lectures per week

Prerequisite: COTTON 401

This course supplements the course in Mill Organization with some added detail regarding the work in Organization. In addition, this course includes work on equipment arrangement for practical routing and operation, auxiliary equipment necessary for manufacturing efficiency, job descriptions and job assignments.

DESIGN

DES. 101 or 102 ELEMENTARY TEXTILE DESIGN 3 CREDIT HOURS

Three lectures per week

One hour of laboratory

Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and the derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from the design, and vice versa; extending and extracting weaves. The various topics discussed include relations and determinations of yarn numbers of cotton, woolen, worsted, silk, and yarns made from man-made fibers; grading of yarns, folded, ply, novelty and fancy yarns.

DES. 112 HANDLOOM WEAVING 1 CREDIT HOUR

Three hours of laboratory per week

This work consists of making original patterns and cloth construction. This subject correlates with the textile design work and aims to stimulate and inspire the student-designer to realize possible combinations of weave and color in a variety of yarns in order to produce fabrics for different purposes.

DES. 122 PERSPECTIVE 1 CREDIT HOUR

Two hours of laboratory per week

This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye. This aids the student in freehand drawing.

DES. 132 FREEHAND DRAWING 1 CREDIT HOUR

One two-hour laboratory period per week

This subject consists of freehand practice, by means of progressive steps, in training the eye to see accurately and to develop skill in depicting desired effects. It includes quick sketching and finishing drawings of objects and of nature to build a drawing vocabulary which will be an aid to decorative expression.

DES. 203–204 TEXTILE DESIGN AND CLOTH CONSTRUCTION 5 CREDIT HOURS

Two lectures per week

One two-hour laboratory period per week

Prerequisite: DES. 102

In the first term, consideration is given to cotton fabrics using plain, twill, or sateen constructions, and employing stripe, check, or plaid colorings. In the second term, fabrics studied are those having extra warp and extra filling figured patterns, together with Bedford cords, velveteens, plushes and corduroy fabrics. In both terms, the work includes the analysis of the fabrics as well as the necessary calculations required to reproduce them or to construct fabrics of similar character.

Des. 211–212 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 5 Credit Hours

Two hours of laboratory per week

Prerequisite: Des. 102

In the first term instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second term instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas and extra warp and filling figures.

Des. 222–223 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 4 Credit Hours

One hour laboratory-demonstration per week

Prerequisite: Des. 101

This course offers work similar but less detailed to the material covered in Design 203–204 and Design 301–302.

Des. 224 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 2 Credit Hours

One hour laboratory per week

Prerequisite: Des. 101

This is a skeleton course patterned after Des. 222–223.

Des. 232–233 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 4 Credit Hours

One laboratory-demonstration per week

Prerequisite: Des. 101

This course offers work similar but less detailed to the material covered in Des. 211–212 and Des. 311–312.

Des. 234 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 2 Credit Hours

One laboratory-demonstration per week

Prerequisite: Des. 101

This is a skeleton course patterned after Des. 232–233.

Des. 242 DECORATIVE DESIGN 1 Credit Hour

Two hours of laboratory per week

Prerequisite: Des. 122, 132

Through the principles of decorative design an understanding is acquired for the proper balance, distribution and repetition of motifs suitable for both the woven and the printed pattern. Historic designs of different periods and peoples are covered to supply the student with a background of decorative information. This source of inspiration is coupled with modern thought and application, as an aid to producing appropriate present-day decorative textiles.

Des. 251–252 COLOR 4 Credit Hours

One lecture per week

One hour of laboratory per week

This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks plaids and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question.

Des. 262 COLOR 1 Credit Hour

One lecture per week

One hour of demonstration per week

This course covers the same general information as Des. 251–252 but in lesser detail.

Des. 272 COLOR 1 Credit Hour

One lecture per week

One hour of demonstration per week

This course covers the same general information as Des. 262 but deals in blends of colored stock.

Des. 301–302 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 5 Credit Hours

Two hours of laboratory per week

Prerequisite: Des. 203–204

During the first term, consideration is given to weave construction of two, three, and four-ply fabrics, together with the analysis of these fabrics in wide woven, and narrow woven elastic and non-elastic belts and webs. Also studied are piques, lappets, and swivel woven fabrics. In the second term, Mitchelins, loose and fast-back quilting fabrics and toilet' cloths are studied, together with a complete course in leno woven cloths.

Des. 311–312 TEXTILE DESIGN AND CLOTH CONSTRUCTION

Two lectures per week 5 Credit Hours

One two-hour laboratory period per week

Prerequqisite: Des. 211–212

This includes cost estimating for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs as well as the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, counts of yarn and value. Particular attention is given to the construction of new designs by the use of suggestion sheets as well as to the new fabrics to be constructed upon a base fabric, previously analyzed, along the lines outlined on the suggestion sheets and keeping within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. This course is restricted to wool, worsted and synthetic fabrics.

Des. 401 TEXTILE DESIGN AND CLOTH CONSTRUCTION

One lecture per week 2 Credit Hours

One two-hour laboratory period per week

Prerequisite: Des. 302, 312

The first half of the term is devoted to the study of Leavers lace including history, manufacture, finishing, a detailed study of the Leavers machine, and the basic principles of lace design and drafting. The second half of the term covers a study of the principles of construction and analyses of Chenille, Wilton, Brussel, Tapestry, Velvet, and Axminster carpets.

Des. 402 TEXTILE DESIGN AND CLOTH CONSTRUCTION

One lecture per week 2 Credit Hours

One hour of laboratory per week

Prerequisite: Des. 101 or 102

Suggested preliminary: Des. 203

Consideration is given to the analysis and comparison of various synthetic fabrics, as to the construction, denier of the yarn, filament count, weave and finish. Some time is also spent in analysis of spun rayon and allied cloths.

Des. 411–412 JACQUARD DESIGN AND WEAVING 4 Credit Hours

One lecture per week

One two-hour laboratory period per week

Prerequisites: Des. 102, 242, Weav. 301–302

This subject correlates the instruction in weaving of the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics The student is taught to transfer his original sketch to cross section design paper, to choose the proper weave for both the background and foreground, to cut cards and lace, and to weave the fabric:

Des. 414 JACQUARD DESIGN 1 Credit Hour

One two-hour laboratory-demonstration per week

Prerequisite: Des. 102

The student is taught to transfer a given motif to cross section paper, to choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to enable the student to appreciate the complete operation from the motif to the loom.

Des. 421 or 422 DESIGN SEMINAR

Hours to be arranged

Prerequisite: Major in Course III or by special permission

This course consists of field trips to selected mills, alternating with reports and seminar discussion of field work.

ECONOMICS

Eco. 201–202 ECONOMICS 6 Credit Hours

Three lectures per week

A basic course in the principles and practices of economics. The course will also deal briefly with economic history, showing how the present economic sys-

tem has evolved from past systems and will point out how the experience of the past can aid in the solution of present problems.

Eco. 311 ECONOMIC STATISTICS 3 Credit Hours

Three lectures per week

This course covers the basic concepts of the statistical method with special emphasis on those approaches of most interest to the student of management. Topics covered include: measures of central tendency, graphic methods, dispersion, skewness, sampling, normal curve, index numbers, correlation, time series, secular trend, seasonal variation, business cycle and statistical forecasting.

Eco. 321 PRINCIPLES OF MARKETING 3 Credit Hours

Three lectures per week

An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and the functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries. It will also consider the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed.

Eco. 322 MARKETING METHODS 4 Credit Hours

Four lectures per week

Prerequisite: Eco. 321

A continuation of Principles of Marketing, Eco. 321. Some of the subjects studied are: economic aspects of fashion, branding, sales promotion and advertising, market research, analysis of distribution costs, forecasting, market potentials, price policies, legal aspects of marketing, vertical integration, sales planning and control and the complete campaign.

Lectures and the case method of instruction will be employed.

Eco. 340 PRINCIPLES OF ACCOUNTING 3 Credit Hours

Three lectures per week

This course is a survey of accounting principles with emphasis upon the nature, interpretation, and utilization of accounting data. The introductory material will include a consideration of the economic significance of accounting, the underlying accounting concepts, the theory of debits and credits, and the organization and use of accounting records. Attention will then be given to the preparation and interpretation of reports and statements of financial position, such as the balance sheet and the statement of profit and loss. Finally, the course material will be projected to include a study of basic credit considerations such as determination of risk, analysis of mercantile reports and the studying of creditor-debtor relationship.

Eco. 341 TEXTILE COSTING 3 Credit Hours

Three lectures per week

Prerequisite: Eco. 340

(Not offered in 1949-1950)

This subject is planned to give a knowledge of modern methods of cost accounting with emphasis upon their application to textile manufacturing processes.

It includes discussion of methods of handling and accounting for raw materials, direct labor, overhead and its distribution, normal costs and their pre-determination, budgeting, cost reports and their use for control purposes.

Eco. 344 PRINCIPLES OF SELLING AND ADVERTISING

Four lectures per week 4 CREDIT HOURS

A comprehensive course dealing with the fundamental principles of advertising and salesmanship. Topics covered include: psychology of selling and advertising, copy writing, layout, printing and engraving, testing and research, planning an advertising campaign, government restrictions, types of media, radio advertising, trademarks, building a selling talk, fundamentals of salesmanship, types of personal selling, personality, retail salesmanship, training etc.

Eco. 351 TEXTILE MARKETING 2 CREDIT HOURS

Two lectures per week

This course is a condensation of the more important parts of Eco. 321 and 322, of particular interest to those not specializing in distribution. It will survey the marketing channels for textiles, chief intermediaries, fashion, branding, marketing research, vertical integration and sales promotion.

Eco. 412 INDUSTRIAL MANAGEMENT; PRINCIPLES AND PROBLEMS 4 CREDIT HOURS

Four lectures per week

The course is divided into four general areas: Backgrounds of Modern Industry; Organization of the Industrial Enterprise; The Operation of the Modern Industry; and Coordination of the Productive Processes. The text material is supplemented with current readings and case material.

Among the topics covered are: Risks, Forecasting, Financing, Product Development, Plant Layout, Production Controls, Personnel Management, Time and Motion Studies, Job Evaluation, and Wage and Salary Administration.

Eco. 421 FOREIGN TRADE 3 CREDIT HOURS

Three lectures per week

Prerequisite: Eco. 201–202

This course will study the growth and development of foreign trade, international commercial policies, transportation and communication facilities, and international finance. A good portion of the term's work will be devoted to a study of the practical aspects of exporting and importing. Examples will be given in the textile field wherever possible and actual documents relating to foreign trade will be exhibited and used in regular class work.

Eco. 431–432 SELLING POLICIES 6 CREDIT HOURS

Three lectures per week

Prerequisite: Eco. 322

This course will cover the development of administrative policy and guiding principles in the marketing, pricing, styling and merchandising of textile products. Topics covered include: sales supervision and control, credit policies, inventory

control, standardization and simplification, the sales contract, arbitration, trade associations, principles of wholesaling and retailing, use of cost accounting in distribution.

The second term is conducted by the seminar method and includes discussions and reports on business cases involving all phases of management and distribution policy.

Eco. 468 CORPORATION FINANCE 3 Credit Hours

Three lectures per week

Prerequisite: Eco. 340

This course will study the instruments of corporate finance, the financing of business enterprises, the legal nature of the corporation, technical features of stocks and bonds, principles of capitalization, working capital management, surplus and dividend policies, business combinations and business reorganizations.

ENGINEERING

Eng. 102 MECHANISM 4 Credit Hours

Three lectures and one recitation per week

The principles studied are of general application, textile machinery in particular furnishing an unusually large variety of specific examples. Frequent reference is made to these examples in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, epicyclic gear trains, and intermittent motion devices.

Eng. 104 MECHANISM 2 Credit Hours

Two lectures per week

This course is an abbreviation of Eng. 102 and is designed for those students not majoring in engineering.

Eng. 111-112 ENGINEERING DRAWING 4 Credit Hours

Six hours of laboratory per week

This course consists of both freehand and mechanical drawing and covers the following items: lettering, geometric construction, orthographic projection, isometric and cabinet drawing, auxiliary views, cross sections, dimensioning, sketching of machine parts, working drawings, tracing and blueprinting, intersections and developments.

Eng. 122 MACHINE TOOL LABORATORY 1 Credit Hour

Three hours of laboratory per week

A similar but abbreviated course to Eng. 232-233.

Eng. 201 MACHINE DRAWING 1 Credit Hour

Three hours of laboratory per week

Prerequisite: Eng. 112

This course is made up of several short problems involving centers of gravity, counterweights, cam layouts, piping, welding, sheetmetal drafting, assembly drawings.

Eng. 212 HEAT AND POWER 3 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisite: Phys. 201

An abbreviation of Eng. 312 and Eng. 411, designed for those not majoring in engineering.

Eng. 221 TEXTILE MECHANISM 1½ Credit Hours

One lecture per week

One two-hour laboratory period per week

Prerequisites: Eng. 102-111-112

This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself.

Eng. 222 APPLIED MECHANICS 3 Credit Hours

Three lectures per week

Prerequisites: Math. 201, Phys. 101

This subject covers the fundamentals of statics and kinetics, including such topics as force systems, laws of equilibrium, centers of gravity, moments of inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies.

Eng. 232-233 MACHINE TOOL LABORATORY 2 Credit Hours

One three-hour laboratory period per week

Systematic instruction is given in the most approved methods of machine shop practice to familiarize the student with the proper use of hand and machine tools. Actual work is given in the operations of filing, laying out, straight and taper turning, thread cutting, drilling, boring, planing, shaping, grinding, and milling including gear cutting. Special attention is given to the form, setting, grinding and tempering of tools, and the mechanism of the different machines. Lectures and demonstrations cover such topics as the characteristics of metals, foundry practice, forging, piping, welding, soldering, and die casting.

Eng. 301-302 ADVANCED APPLIED MECHANICS 6 Credit Hours

Three lectures per week

Prerequisites: Eng. 222, Math 202

This subject covers the general topic of strength of materials; including such topics as simple stresses, strain, bending moments, shearing force, slopes and deflections in beams, beam design, torsion, and design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, and stress analysis by strain gage methods.

Eng. 311 HEAT ENGINEERING 4 Credit Hours

Three lectures per week

One two-hour laboratory period per week

Prerequisites: Math. 202, Phys. 202, Eng. 102

This course is a condensation of Eng. 312 and Eng. 411

ENG. 312 HEAT ENGINEERING 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisites: MATH 202, PHYS. 202

The purpose of this course is to familiarize the student with the principles of elementary thermo-dynamics, the properties of steam, mechanical mixtures and combustion of fuels.

ENG. 321 STRENGTH OF MATERIALS 3 CREDIT HOURS

Three lectures per week

Prerequisites: PHYS. 101, MATH. 201

A more elementary and condensed treatment of ENG. 301-302.

ENG. 331 MILL ENGINEERING 3 CREDIT HOURS

Three lectures per week

Prerequisite: ENG. 222

This course consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construction from a study of actual blueprints; calculation of allowable floor loads; stresses in beams and columns; and machinery layout.

ENG. 332 ENGINEERING MATERIALS 2 CREDIT HOURS

Two lectures per week

Prerequisite: PHYS. 202

This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treatment; also the properties and uses of non-metallic engineering materials such as timber, cement, concrete, rubber, plastics, and mechanical fabrics.

ENG. 342 ELECTRICAL MACHINERY 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisite: PHYS. 321

At the beginning of this subject electronic circuits are considered, but the greater part of the term is devoted to direct current generators and motors with a study of their construction and characteristics. Some time is devoted to electrical measurements.

ENG. 344 ELECTRICAL MACHINERY 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisite: PHYS. 321

This course is a condensation of ENG. 342 and ENG. 401.

ENG. 351 STATISTICS 3 CREDIT HOURS

Three lectures per week

Prerequisite: MATH. 202 or 203

The first part of the course deals with those fundamental statistical measures which are required for the analysis of experimental data and for an understanding of the statistical control of quality. The second part of the course is devoted to the practical applications of statistics to textile mill operation.

ENG. 401 ELECTRICAL ENGINEERING 4 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisite: ENG. 342

This subject includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for this motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor.

ENG. 402 TEXTILE APPLICATIONS OF ELECTRICITY

One field trip per week 1 CREDIT HOUR

Prerequisite: ENG. 344 or 401

This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. The work is covered by trips made to local mills to see the equipment in actual operation.

ENG. 411 ADVANCED HEAT ENGINEERING 3 CREDIT HOURS

Two lectures per week

One two-hour laboratory period per week

Prerequisite: ENG. 312

The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detailed discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course, the historical development, classification and types of turbines and gas engines are discussed.

ENG. 422 TEXTILE PROCESS INSTRUMENTATION

Two lectures per week 2 CREDIT HOURS

Prerequisites: PHYS. 321, ENG. 311 or 312

This course is divided into three parts. First, a study is made of the indicating and recording instruments used to measure such common textile process variables as pressure, temperature, humidity, liquid level, fluid flow, etc.

The second part covers an analysis of the mechanisms (pneumatic and electric) which are used to control these variables, and includes a detailed discussion of the final control elements, such as valves and motor levers, which are associated with the controller mechanisms.

Finally, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, and finishing are studied from data obtained from actual mill installations.

ENG. 424 MACHINE DESIGN 3 CREDIT HOURS

Two lectures per week

One two-hour laboratory period per week

Prerequisites: ENG. 221, 233, 302

Dealing first with the design of fundamental machine elements, the work leads to the design of critical parts of some textile machines.

ENG. 431 ADVANCED PHYSICAL TESTING 2 CREDIT HOURS

One lecture per week

One three-hour laboratory period per week

Prerequisite: TEX. 311

This course provides a more detailed analysis of the textile testing methods currently utilized in the industry, both in quality control and in research, extending the laboratory work to cover a wider variety of equipment than studied in TEX. 311-312.

ENGLISH AND HUMANITIES

ENGL. 101-102 ENGLISH COMPOSITION AND LITERATURE

Three hours per week 6 CREDIT HOURS

A basic course in rhetoric and composition, relating specifically to the four forms of discourse, viz., description, narration, exposition, argumentation. In addition, a selected group of classics is studied and discussed.

ENGL. 201 or 202 SPEECH 2 CREDIT HOURS

Two hours per week

The aim of this course is to achieve effective delivery of various types of speech. All kinds of delivery — extemporaneous, impromptu, memorized, etc., are studied and analyzed.

ENGL. 211 or 212 BUSINESS ENGLISH 1 CREDIT HOUR

One lecture per week

Analysis and practice in letter-writing, and a study of the basic forms of technical exposition, forming a background for report writing in advanced courses and in industrial activity.

ENGL. 222 APPRECIATION OF LITERATURE 3 CREDIT HOURS

Three hours per week

Prerequisite: ENGL. 102

This subject is offered for those who wish to study the principles of literary appreciation and criticism.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals — the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical.

Emphasis will also be placed upon the value of an extensive reading program.

FINISHING

FIN. 401-402 WOOLEN AND WORSTED FINISHING

Two lectures per week 6 CREDIT HOURS

One three-hour laboratory period per week

Prerequisites: WOOL 302, 312, DES. 233, CHEM. 102, ENG. 102

This course is designed to give the student a comprehensive introduction and orientation to the physical rather than chemical aspects of finishing, and includes

burling and mending, fulling, washing and speck dyeing, carbonizing, gigging, napping, steaming, singeing, crabbin, brushing, shearing, and pressing.

FIN. 412 WOOLEN AND WORSTED FINISHING
Three lectures per week 4 CREDIT HOURS
One three-hour laboratory period per week
Prerequisites: WOOL 302, 312, DES. 233, CHEM. 102, ENG. 102

This course is a similar but abbreviated version of FIN. 401–402, designed for students not majoring in wool manufacture.

FIN. 421-422 COTTON AND RAYON FINISHING 6 CREDIT HOURS
Two lectures per week
One three-hour laboratory period per week
Prerequisites: COT. 302, DES. 223, ENG. 102, CHEM. 102

This subject is designed to cover the more important physical finishing operations employed in handling cotton and other cellulosic type textiles, and includes cloth room operation, shearing, singeing, washing, water and starch mangles, dryers and stretchers, calenders, quetch and mangles, decating, make-up, yarding, winding, pressing, and papering.

FIN. 431 COTTON AND SYNTHETIC FINISHING
Three lectures per week 4 CREDIT HOURS
One three-hour laboratory period per week
Prerequisites: COT. 302, DES. 223, ENG. 102, CHEM. 102, 221, TEX. 302

The subject is offered as the final step in the integration of cotton and synthetic fibers from the raw material to the consumer product. It consists of all major operations necessary in the transformation of the staple grey fabrics of the above content except the bleaching and dyeing which is given separately. These operations consist of shearing, singeing, washing, padding or mangling, miscellaneous drying, calendering, etc. Among the group of finishes and backfilling, softening, repelling, stabilizing, decating, etc. Also considered are the application of thermoplastic and thermosetting resins by padding and coating.

KNITTING

KNIT. 401 KNITTING 4 CREDIT HOURS
Two lectures per week
Five hours of laboratory per week
Prerequisites: ENG. 102, DES. 102

This course is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

KNIT. 403 or 404 KNITTING 3 CREDIT HOURS
Two lectures per week
One three-hour laboratory period per week
Prerequisites: ENG. 102, DES. 102

This course is similar to KNIT. 401, but has less laboratory time than KNIT 401.

KNIT. 412 ADVANCED KNITTING

Hours to be determined

Prerequisite: KNIT. 401

This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems.

LANGUAGES

GERMAN 301-302 TECHNICAL GERMAN 6 CREDIT HOURS

Three hours per week

An introductory course in the basic elements of German, leading to a working knowledge of technical German. This course is aimed primarily at developing a reading ability in scientific German.

GERMAN 501-502 ADVANCED TECHNICAL GERMAN 6 CREDIT HOURS

Three hours per week

Prerequisite: GER. 302 or equivalent

German 501 may be taken without continuing GERMAN 502

This course is designed to expand the student's elementary understanding of the language, to increase vocabulary, and to develop reading aptitudes in special fields of interest selected by the student.

MATHEMATICS

MATH. 101-102 COLLEGE MATHEMATICS 8 CREDIT HOURS

Four hours per week

The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms, graphical and mathematical solution of quadratic and simultaneous equations, and the theory of equations are studied. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term, the following topics are considered: equations of the straight line, equations of various curves, differentiation of algebraic functions, maximum and minimum values, rates and differentials.

MATH. 201-202 MATHEMATICS 6 CREDIT HOURS

Three hours per week

Prerequisite: MATH. 101-102

In the first term the following topics are treated: exponential functions, the circle, parabola, ellipse, hyperbola, polar coordinates, indefinite integrals, summation by integration and applications of integration. In the second term the topics treated are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas.

MATH. 202 MATHEMATICS 4 CREDIT HOURS

Four hours per week

Prerequisite: MATH. 101-102

This subject is a one-term continuation of the work of MATH. 101-102. A study of the derivatives and differentials is followed by applications of the differ-

ential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, trigonometric functions. *This course is designed for those not continuing in engineering.*

MATH. 204 MATHEMATICS 2 CREDIT HOURS

Two hours per week

Prerequisite: MATH. 203

This subject is for students of chemistry and dyeing who have completed an introduction to analytic geometry and calculus. The following topics are taken up: precision of measurements, use of numbers in calculation, semi-logarithmic and logarithmic graphs, polar coordinates, three component heterogeneous systems, empirical equations, methods of least squares, series, differential equations with chemical applications, and partial derivatives.

MATH. 501 DIFFERENTIAL EQUATIONS 3 CREDIT HOURS

Three hours per week

Prerequisite: MATH. 201-202

The following topics are treated: a review of series and partial differentiation, first and second-order differential equations, and first and second-order partial differential equations. The practical applications illustrated are designed for the chemist and the engineer.

PHYSICS

PHYS. 101 PHYSICS 4½ CREDIT HOURS

Two lectures and one recitation per week

One two-hour laboratory period every other week

The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, efficiency of simple machines, hydrostatics, elements of hydraulics, circular and harmonic motions.

PHYS. 201-202 PHYSICS 8 CREDIT HOURS

Three lectures per week

One two-hour laboratory period per week

Prerequisite: PHYS. 101

A basic course relating to the laws and principles of physics and their application. The topics taken up the first term are: wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are: reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis, electronics, and elements of nuclear physics.

Phys. 321 ELECTRONICS 3½ Credit Hours

Three lectures per week

One two-hour laboratory period every other week

Prerequisite: Phys. 202

This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. It includes elements of vacuum and gaseous-tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation.

Phys. 401 ADVANCED MICROSCOPY 2 Credit Hours

One lecture per week

One three-hour laboratory period per week

Prerequisites: Tex. 312, Phys. 202, Math. 201 or 203

This course emphasizes a complete physical understanding of the techniques of the microscopist, including the microscope using normal, fluorescent and polarized light, discussions of phase microscopy, staining, etc. Some aspects of microtechnique and photomicrography will be included.

Phys. 402 ADVANCED TEXTILE PHYSICS 3 Credit Hours

Two lectures per week

One three-hour laboratory period per week

Prerequisites: Tex. 312, Phys. 202, Math. 202

Textile Physics is designed primarily for graduate students but may be taken by seniors who have sufficient knowledge of elementary college physics, microscopy and testing. It deals in an analytical and experimental manner with the principles of advanced physics which have important applications to textile technology. The topics taken up include heat transmission of textile materials; color measurement; calculation of tristimulus values; transformation to dominant wave-length; colorimetric purity and brightness; measurement of refractive index of fibers; applications of phase microscopy; fluorescent microscopy; use of X-ray diffraction methods to determine crystal orientation and structure of fibers; spectrographic analysis; investigation of mineral elements in textile fibers; accurate methods of measuring stress, strain, viscosity, etc. There will be lectures, laboratory work, and assigned reading.

Phys. 501 or 502 THE PHYSICS OF COLOR MEASUREMENT

Hours to be arranged 3 Credit Hours

Prerequisites: Phys. 202, Math. 201 or 203

Color measurement is an elective subject for graduate students who desire a comprehensive knowledge of the philosophy and practice of modern colorimetry. The topics covered include colorimeters, their uses and limitations, spectrophotometers, tristimulus values, dominant wave-length and purity, the "standard observer" concept, the Munsell system, the Ostwald system, color tolerances, gloss and body color, illuminants, and industrial applications.

Laboratory instruments available consist of brightness testers, monochromatic and trichromatic colorimeters, recording and visual spectrophotometers.

SOCIAL SCIENCE

Soc. Sci. 212 WORLD HISTORY SINCE 1900 3 Credit Hours

Three lectures per week

A study of the backgrounds in political, economic, and social conditions in the years preceding the outbreak of World War I, an examination of the world situ-

ation during the war years, 1914 to 1918, and a thorough review of the issues at Versailles and the spirit and content of the several treaties and settlements effected at the peace table. The body of the course content will concern the two-decade intermission, 1919-1939, with attention to such factors as the rise of new states, the origin and development of new concepts of nationalism, racism, and other phenomena, and the final alignment of world powers for World War II. The emphasis in the latter part of the course will be upon the role of the United States in mid-twentieth century reconstruction and rehabilitation through world-wide international cooperation in agencies like the United Nations Organization, the International Bank, and others in which the United States must play a leading part.

Soc. Sci. 221 ECONOMIC HISTORY; THE UNITED STATES
Three lectures per week 3 Credit Hours

This course offers a study of the foreign and American backgrounds of the economic development of the United States since 1800. Special emphasis is placed upon the Industrial Revolution in America prior to the Civil War and upon the growing international economic importance of American manufacturing and trade during the period.

The major emphasis is upon the post-Civil War development of transportation, finance, manufacturing, and commerce and on the influence of these and other factors in the rise of corporate ownership and mass production and in the development of our present-day machine economy. Particular attention will be given to the economic influences of the two World Wars and to the post-war trends in general business conditions and their effects upon the national economy.

Soc. Sci. 301 INDUSTRY AND SOCIETY 3 Credit Hours
Three lectures per week

. A study of American industrial history since 1870. This course provides the background of modern labor problems, and is intended to develop an appreciation of the many complex factors which make current management-labor relations a matter of major concern in society today.

Soc. Sci. 302 MODERN LABOR PROBLEMS 3 Credit Hours
Three lectures per week
Prerequisite: Soc. Sci. 301

The course will involve the use of a manual of current labor laws which apply in Labor-Management relationships in the United States. Case material will be studied to familiarize the students with Federal and State court actions, rulings of the National Labor Relations Board, and the functions of both public and private conciliators and arbitrators. At intervals during the course the class will meet informally with representatives of both Labor and Management, and opportunities will be provided for discussion of important points with the visiting speakers. The chief objectives of the course will be (1) a proper consideration of the important current issues in collective bargaining and (2) the development of familiarity with the techniques of the bargaining table and the problems in drafting, interpreting, and administering the modern labor contract.

Soc. Sci. 401 INDUSTRIAL RELATIONS SEMINAR
Two hours per week 2 Credit Hours
Prerequisite: Soc. Sci. 302

This course will give a small selected group opportunities to meet with the instructor and occasional visitors in discussion of current problems in industrial

relations. Case material and hypothetical problems in modern labor management will provide the basis for the study by the group.

Soc. Sci. 461 PERSONNEL MANAGEMENT 3 Credit Hours
Three lectures per week

This course involves a comprehensive study of modern labor management techniques in the recruiting, selection, training, and placement of members of the work force. Major emphasis is placed upon the development and maintenance of personnel administration agencies and procedures within the framework of present-day American industry, with special attention to such matters as employee health and safety, welfare and recreation programs, wage and salary administration, training and education, and management relations with labor organizations.

In addition to text material and selected readings, problems will be drawn from actual cases for study and solution by the students. Every effort will be made to acquaint the class with current personnel administration practices in industrial organizations of various types, and to give an appreciation of the importance and magnitude of the labor management function.

Soc. Sci. 463 BUSINESS LAW 3 Credit Hours
Three lectures per week

This course will cover the basic principles of commercial law. Topics studied include: contracts, agency, sales, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guarantee, and bankruptcy.

Soc. Sci. 465 MANAGEMENT PROBLEMS SEMINAR
Hours to be arranged 2 Credit Hours
Prerequisite: Permission of Instructor

A seminar for a group of selected students who will, under the guidance of the instructor, investigate one or more areas of special interest to the student in the field of finance, production or distribution. The results of the students' analysis and research will be presented in a formal report which will be permanently on file in the library.

SYNTHETIC TEXTILES

Syn. 102 ORIENTATION IN SYNTHETIC TEXTILES
One hour per week ½ Credit Hour

This seminar for freshmen who have elected to major in synthetic textiles has for its purpose the general integration, in the mind of the student, of the various courses in his curriculum in terms of his educational objective. Since the student does not begin intensive study in synthetic textiles until his junior year, it is of vital importance that he be fully aware and fully understanding of the significance of the basic educational program of the first two years.

Syn. 301 FILAMENT YARN PROCESSING 2 Credit Hours
Two lectures per week
Suggested Preliminary: Tex. 201-202

This subject deals with the processing of man-made continuous filament fibers from the time they are made available to the textile industry by the manufacturer until they are ready for processing into fabric forms. The nomenclature, pur-

poses, means of accomplishment, and results obtained in the various operations of soaking, winding, throwing, twist setting, coning, and single end sizing are covered in the lectures.

Syn. 302 THROWING PLANT ORGANIZATION
Two lectures per week 2 Credit Hours
Prerequisite: Syn. 301

This subject is essentially a continuation of Syn. 301, with the emphasis being placed upon actual plant organization, processing procedures, and quality control. Plant layouts from machinery viewpoints are discussed and assigned for study. Field trips to local plants are an integrated part of the class work.

Syn. 311-312 SYNTHETIC FIBERS 6 Credit Hours
Three lectures per week
Prerequisites: Phys. 201-202, Chem. 201-202

This course deals with the manufacture and properties of man-made fibers. The rayons, polyamides (nylons), vinyl, protein, mineral, and metallic fibers are considered from the standpoint of their manufacture and economic aspects, and their fundamental structure and properties. An attempt is made to correlate the material so that a critical evaluation of the fibers can be made. Part of the course is conducted in the manner of a symposium, with the students reporting on current research and work on man-made fibers, as reported in the contemporary literature.

Syn. 322 SURVEY OF FILAMENT PROCESSING
Two lectures per week 2 Credit Hours
Prerequisite: Tex. 102

A survey of the methods of handling synthetic fibers in filament form designed to give the student a broad picture of the differences and their significances between staple and filament yarn production. Some of the lecture time will be devoted to laboratory demonstration and outside assignments may be made involving special use of the laboratory equipment.

Syn. 331-332 FILAMENT YARN LABORATORY 2 Credit Hours
One three-hour laboratory period each week
Prerequisite or Concurrent Subject: Syn. 301

This subject covers the laboratory aspects of Syn. 301, and consists of planned experiments and demonstrations involving the use of throwing machinery and processes by the student. Experiments include various yarn soaking studies. winding, twisting, coning and single end sizing operations, and quality control and power studies.

Syn. 411-412 SYNTHETIC FIBERS 6 Credit Hours
Three lectures per week
Prerequisite: Syn. 311-312

This course is a continuation of Syn. 311-312. It is conducted as much as possible as a seminar with numerous symposia. Much of the time will be spent on considerations of the fundamental properties and structures of man-made fibers in relation to each other and to the properties of the finished textile. To make the material more useful, natural fibers and their textiles are also included. Recent advances in the manufacture of fibers will be discussed to keep subject matter included in Syn. 311-312 up to date.

SYN. 452 SYNTHETIC TEXTILES SEMINAR 2 CREDIT HOURS
Four to five hours per week
Prerequisites: SYN. 301-302, 311-312, 401, 411

A general discussion of the problems encountered in the synthetic textile field, including economics, manufacture, processing, properties and various aspects of research. Recent advances and projected developments will be covered. Participation by both students and instructors in the seminar is aimed at developing an objective viewpoint of the subject in the student.

TEXTILES — GENERAL

TEX. 101 SURVEY OF TEXTILES 1 CREDIT HOUR
Two lectures per week

This subject is designed to give the student elementary knowledge of the textile industry so that he can choose his future course more intelligently, and so that he can better understand the relations between the various branches of the industry.

TEX. 102 INTRODUCTION TO FIBERS 2 CREDIT HOURS
Two lectures per week

A general survey of the fibers used in the textile industry, including natural cellulosic (soft and hard), protein, and mineral fibers and the man-made fibers. The sources (location and distribution), the economics, and the preparation of the fiber for textile uses will be discussed. An introduction to the elementary properties of fibers making them suitable for specific textiles will also be presented.

TEX. 201-202 TEXTILE MANUFACTURING 6 CREDIT HOURS
Two lectures per week
One three-hour laboratory period per week
Prerequisite: TEX. 102

This course is designed for those not majoring in cotton or wool manufacture and covers the basic processes and basic textile manufacturing systems as they relate to all of the important textile fibers. The objective of this course is to develop a fully integrated picture of the significance of textile processes to the effective utilization of the several textile fibers and of the comparative results of each system and/or process.

TEX. 241 LIBRARY 1 CREDIT HOUR
One hour per week

This is a subject to introduce the student to the effective use of a library and to familiarize him with the past and current sources of information on textile topics.

TEX. 302 PROPERTIES AND APPLICATION OF FABRICS
Two lectures per week 2 CREDIT HOURS
Prerequisite: DES. 101 or 102

This course is designed to acquaint the student with many of the important fabric types in use today for wearing apparel, home furnishings, and industrial uses. An analytical discussion is used so that the student may not only identify the fabrics but also understand the significance of the weave, design, yarns, etc., used.

Tex. 311-312 TEXTILE TESTING 6 Credit Hours

Two lectures per week

One two-hour laboratory period per week

Prerequisites: Chem. 102, Phys. 202, Math. 102

This course familiarizes the student with the basic physical, chemical, and optical techniques in common use in the textile industry for quality control and in some measure in research. These basic testing tools are integrated with an elementary introduction to statistics and used in the solution of typical problems of textile evaluation.

Tex. 422 METHODS OF RESEARCH 2 Credit Hours

Two hours per week

Prerequisites: Seniors and Graduate Students only

A seminar to familiarize the student with the philosophy and methods of research; current problems in textile research; and in the further use of textile literature.

Tex. 431 FABRIC DEVELOPMENT 2 Credit Hours

Two lectures per week

Prerequisites: Math. 202, Phy. 202, Eng. 321

This subject correlates the engineering properties of textile materials with engineering principles and textile processing to produce fabrics with desired properties. The principles of structure of mechanical fabrics and those in the consumer goods classification are considered.

WEAVING

Weav. 201-202 WEAVING 6 Credit Hours

Two lectures per week

Two two-hour laboratory periods per week

The first term deals with the study of the cam loom, its principal and auxiliary motions; a comparison to other types of looms, and a study of weaving terms and the cloth defects of weaving. The second term covers all methods of warp preparation of all yarns with emphasis upon the conditions favorable to each system or combinations of systems.

Weav. 211-212 WEAVING 5 Credit Hours

Two lectures per week

One two-hour laboratory period per week

This course is similar to Weav. 201-202, but utilizes less laboratory time.

Weav. 221-222 WEAVING 4 Credit Hours

Two lectures per week

This course, designed for non-manufacturing majors, includes the same lecture material as Weav. 201-202, but includes no laboratory work other than lecture-demonstrations and assignments.

Weav. 301-302 WEAVING 6 Credit Hours

Two lectures per week
Two two-hour laboratory periods per week
Prerequisite: Weav. 201

This course covers dobby weaving and includes single and double index, single and double cylinder, chains, timing, and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics, silk and narrow webbing. This course also covers pile cloth weaving, carpet weaving and leno weaving.

Weav. 311-312 WEAVING 5 Credit Hours

Two lectures per week
One two-hour laboratory period per week
Prerequisite: Weav. 211

This course is similar to Weav. 301-302, but utilizes less laboratory time.

Weav. 321-322 WEAVING 4 Credit Hours

Two lectures per week
Prerequisite: Weav. 221

This course, designed for non-manufacturing majors, includes the same lecture material as Weav. 301-302, but includes no laboratory work other than lecture-demonstration and assignments.

WOOL

Wool 201-202 FIBER PREPARATION 4 Credit Hours

One lecture per week
One two-hour laboratory period per week
Prerequisites: Eng. 102, 112, Chem. 102

A study of fibrous materials which can be processed on the woolen or worsted systems of manufacture. Special emphasis is placed on wool classification; wool scouring, carbonizing, burr picking; raw materials including animal, vegetable, and synthetic fibers and reworked fibers.

Wool 211-212 TOP MAKING 8 Credit Hours

Two lectures per week
Two three-hour laboratory periods per week
Prerequisites: Eng. 102, 112

This course covers the worsted card, back washing, gilling on open and intersecting machines, combing on both French and Noble combs, blending of colors and/or wool and other fibers, tow to top conversion of synthetic fibers, and an analytical study of the properties and classification of top.

Wool 213-214 FIBER PREPARATION 3 Credit Hours

One lecture per week
One two-hour laboratory period every other week
Prerequisites: Eng. 102, 112, Chem. 102

This course covers the same lecture material as Wool 201-202, but the laboratory time is considerably reduced.

Wool 215-216 TOP MAKING 5 Credit Hours

Two lectures per week

One two-hour laboratory period every other week

Prerequisite: Eng. 102, 112

This course covers the same lecture material as Wool 211-212, but the laboratory time is considerably reduced.

Wool 301-302 WOOLEN YARNS 5 Credit Hours

One lecture per week, first semester

Two lectures per week, second semester

One three-hour laboratory period per week, both semesters

Prerequisite: Wool 202

This course relates to fiber blending, oiling, picking; woolen carding, including a comparison of ring and tape condenser systems; woolen spinning, including both mule and ring spinning machines; twisting, covering yarn conditioning as well as the production of fancy twists and novelty yarns for knitting and weaving.

Wool 311-312 SURVEY OF WOOL MANUFACTURE .

Two lectures per week 4 Credit Hours

One hour of laboratory demonstration per week

Prerequisite: Tex. 102

This course is designed for those not majoring in wool manufacture and presents a comprehensive survey of the woolen and worsted processes as they relate to the manipulation of all types of fiber, but with primary emphasis on wool.

Wool 321-322 WORSTED YARNS 9 Credit Hours

Three lectures per week

One three-hour laboratory period per week, first semester

Five hours of laboratory, second semester

Prerequisites: Wool 202, 212

A study of worsted yarn production, covering further work in top analyses, and a study of the French and English systems of yarn production, including twisting for knitting or weaving yarns.

Wool 323-324 WOOLEN AND WORSTED YARNS 11 Credit Hours

Four lectures per week, first semester

Five lectures per week, second semester

One two-hour laboratory period per week

Prerequisite: Wool 214-216

This course covers the same lecture material as Wool 301-302 and Wool 321-322, but the laboratory time is reduced. This course is restricted to those not majoring in Course II.

Wool 411 WOOL MILL ORGANIZATION 4 Credit Hours

Four lectures per week

Prerequisites: Wool 302, Des. 233, Chem. 222

Recapitulation of the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system.

Also summarizes previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades, to cover balanced mill equipment necessary to produce worsted cloth from top on both English and French systems.

ALUMNI ASSOCIATION

The membership of the alumni association of the Institute is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year. Membership also includes Associate and Honorary classifications.

The Association holds its annual business meeting and banquet in the spring of each year.

Communications should be addressed to Prof. A. Edwin Wells, Executive Secretary, Alumni Office, Lowell Textile Institute.

OFFICERS AND DIRECTORS FOR THE YEAR 1948-1949

A. Chester Clifford, 22, *President*

Frank W. Gainey, '11, *1st Vice-President*

Louis Zisman, '20, *2nd Vice-President*

A. Edwin Wells, '20, *Executive Secretary, Clerk and Treasurer*

Ernest P. James, '42, *Assistant Secretary-Treasurer*

ALUMNI FUND COUNCIL

Barney H. Perlmutter, '23, *Chairman*

Milton Hindle, '25, *Chairman,* Fund Committee

James A. Irvine, '17, *Chairman,* Special Gifts Committee

A. E. Wells, '20, *Chairman,* Scholarship Committee

BOARD OF DIRECTORS

Term ending April 1949

Harold E. Clayton, '21
Milton Hindle, '25
E. Perkins McGuire, '28
Richard W. Rawlinson, '31
Raymond R. Stevens, '19

Term ending April 1950

Edward B. Bell, '24
A. Chester Clifford, '22
Frank W. Gainey, '11
Harold W. Leitch, '14
Simon Shapiro, '34

Term ending April 1951

William F. Brosnan, '27
John T. Johnson, '43
Kenneth A. Park, '16
Samuel Pinanski, '12
Louis Zisman, '20

GRADUATES OF 1948

Master of Science in Textile Chemistry

Ramswarup Gulabdas Godiwala
B.S., University of Bombay, 1943
L.T.C., Victoria Jubilee Technical Institute, 1945

*Rita Pearl Landry
B.T.C., Lowell Textile Institute, 1946

Robert Earle Willett
B.S., North Carolina State College, 1938

Henry Kyi-oen Woo
B.S., St. John's University, 1939

Yuan Loong Yang
M.S., St. John's University, 1945

Master of Science in Textile Engineering

Hussein Abdel Maksoud
B.Sc., Fouad I University, 1940

Prakash Chandra
B.A., Punjab University, 1943
L.M.E., Victoria Jubilee Technical Institute, 1946

Aziz Abdel-Kader El-Gammal
B.E.E., Fouad I University, 1943

*John Lawrence Hallett, Jr.
B.S., Lowell Textile Institute, 1947

Ying-Doong Lee
B.S. in T.E., Nantung College, 1944

Ying Kong Lee
B.S. in C.E., St. John's University, 1944

Solomon Marder
B.S. in M.E., Cornell University, 1946

Joseph Arnold Meehan
B.S. in M.E., Tufts College, 1946

Jaromir Jan Pospisil
B.S., United States Military Academy, 1930

William Enoch Vaughn, Jr.
B.S. in T.E., Georgia School of Technology, 1939

Edith Tse-Lieu Voong
B.S. in T.E., Nantung College, 1944

Diploma in Cotton Manufacture

Richard Douglas Merrill
Charles Andrew Whitehead

Diploma in Wool Manufacture

William Charles Bates
Robert Joseph Dinan
Leo Francis Fanning
George Tom Fieldsend
Newton Browder Jones
Richard Bradley Jones
Robert Charles Mathieu
Edward John Mendrala
Raymond Robert Poblocki

Diploma in Textile Design

Douglas Duncan McCord
Nathaniel True Whittier

Bachelor of Science in Textile Chemistry

John Walter Bardzik
Jerome Frederick Bauer
Albert Lawrence Bianco
*Wilfred Leo Boule
Roger Patrick Farren
*Eleanor Elizabeth Foley
*Allen Morris Frank
Nathaniel Henry Glade
John Edward Hirn, Jr.
*Albert Gerard Hoyle
*Joseph Valentine Kopycinski
John Thomas McKniff
*Peter Joseph McKone, Jr.
Alan Martin McNally
*Robert Benjamin Meister
*Gerard Charles Morel
George Campbell Murphy
*Chung-sheng Na
*James Francis O'Donnell
*James Michael O'Flahavan
Stuart Emanuel Penner
James Michael Reynolds
John Michael Roughan
Richard Bernard Simon
Edward Dominic Wielicka

Bachelor of Science in Textile Engineering

Stephen John Bisko
Ping Chao Chan
*Samuel Leighton Clogston
Samuel Zachary Fain
Norman Brown Grime
Francis William Hagerty
*Howard Manley Helland
Henry Talmadge Howland
*James Harrington Kennedy, III
*James Robert King
Charles Joseph Landry
John Badger Leitch
Vernon Russell McKittrick
*Melvin Siegel
Irwin Charles Smoler
*Ray Milton Spofford
Stanley Joseph Werkowski
*Vernon Lee Wilkinson

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*Tau Epsilon Sigma (Textile Scholastic Society)

REGISTER OF STUDENTS

GRADUATE STUDENTS

Home Address	*Lowell Address*
Alpert, Eugene Oliver, VI, Brooklyn, N. Y. B.S., Duke University, 1946	272 Merrimack Street
Barefield, William Carter, VI, Americus, Ga. B.S., Alabama Polytechnic Institute, 1931	Tewksbury, Mass.
Canova, Lester Charles, VI, Holyoke, Mass. B.S., Rensselaer Polytechnic Institute, 1948	31 Waverly Avenue
Chang, Leo Shih-Yen, VI, Shanghai, China B.S., St. John's University, 1944	137 Riverside Street
Conlin, James Joseph, Jr., VI, Jersey City, N. J. B.S., U. S. Naval Academy, 1944	21 19th Street
Crosby, Philip, VI, Sherman, Texas B.S., U. S. Naval Academy, 1944	24 Hawthorne Street
Finnie, Jerrold Nelson, IV, Montreal, Canada B.S., McGill University, 1948	222 Varnum Avenue
Giffler, Bernard, VI, Brooklyn, New York	272 Merrimack Street
Hochschild, Reinhard George, IV, Dracut, Mass. B.T.C., Lowell Textile Institute, 1943	———
Horwitch, Arnold Murray, V, Chicago, Illinois Ph.B., University of Chicago College, 1948	Smith Hall
Iplikci, Ahmet Yasar, VI, Eskisehir, Turkey B.S., Robert College, 1946	123 Riverside Street
Kopycinski, Joseph Valentine, IV, Lowell, Mass. B.S., Lowell Textile Institute, 1948	242 Branch Street
Knowles, Yancey Henry, VI, Mt. Olive, N. C. B.S., Virginia Military Institute, 1939	408 Mammoth Road
Lakshminarayanaiah, Nallanna, IV, Mysore, India M.S., Benares Hindu University, 1945	27 Waverly Street
Longnecker, Kenneth William, VI, Erie, Penn. B.S., U. S. Naval Academy, 1944	North Billerica, Mass.
McWhorter, John Calvin, Jr., VI, Edinburg, Tex. B.S., U. S. Military Academy, 1946	21 Dunbar Avenue
Na, Chung-Sheng, IV, Kumming, China B.S., Lowell Textile Institute, 1948	43 Plymouth Street
Nanda, Dharampal Amarnath, VI, Bombay, India B.S., Bombay University, 1942	28 Riverside Street

O'Flahavan, James Michael, IV Lowell, Mass. B.S., Lowell Textile Institute, 1948	62 Colonial Avenue
O'Neil, John Joseph, Jr., VI, Arlington, Mass. B.S., Tufts College, 1947	406 Pawtucket Street
Quo, Tse-bie, VI, Shanghai, China B.S., Chiao Tung University, 1939	222 Textile Avenue
Rose, Edgar, VI, Cambridge, Mass. M.S., Mass. Institute of Technology, 1948	38 Endicott Street
Scott, Robert Lee, VI, Dallas, Texas B.S., University of Texas, 1941	272 Merrimack Street
Sharma, Sachchida Nand, VI, Bombay, India B.S., Benares Hindu University, 1942	25 Third Street
Solanki, Uttambal Vaghji, IV, Bombay, India B.S., University of Bombay, 1938	25 Third Street
Strum, Louie Willard, Jr., VI, Jacksonville, Fla. B.S., U. S. Naval Academy, 1940	North Chelmsford, Mass.
Tsai, Chang-kaing, VI, Kaingsu, China B.S., National Central University, 1941	123 Riverside Street
Wang, Hsuan-Sun, IV, Shanghai, China B.S., St. John's University, 1946	222 Textile Avenue
Woo, Henry Kyi-Oen, VI, Shanghai, China M.S., (IV), Lowell Textile Institute, 1948	56 Fourth Avenue

OFFICERS TEXTILE TRAINING COURSE

Home Address	*Lowell Address*
Covington, James Coxe, Jr., VI, Columbia, S. C. B.S., Clemson A & M College	North Chelmsford, Mass.
Everton, Theme Troy, VI, San Pedro, California B.S., University of Southern California	North Chelmsford, Mass.
Hilditch, Norman, VI, New Bedford, Mass. New Bedford Textile Institute	272 Merrimack Street
Martin, Marlin C., Jr., VI, Dobbs Ferry, N. Y. A.B., Lafayette College	184 Hildreth Street
Yarborough, William Hugh, VI, Bangs, Texas B.B.A., University of Texas	73 Nesmith Street

Class of 1949

Home Address	*Lowell Address*
Affler, Manuel, VI, Montreal, Quebec	392 Chelmsford Street
Alden, John, VI, Lowell, Mass.	45 Harvard Street
Aslanoglou, George Leomidas, VI, Athens, Greece	43 Plymouth Street
Bess, Leon, V, Paterson, New Jersey	42 So. Walker Street
Bill, Walter Edgar, IV, Lowell, Mass.	17 Plain Street
Blackman, Harvey Bernard, VI, Brockton, Mass.	25 Princeton Blvd.
Braff, Stanford Wolf, VI, Brooklyn, New York	142 Riverside Street
Brassil, Robert Daniel, IV, Lowell, Mass.	404 Wentworth Avenue
Britton, Edward Joseph, IV, Lowell, Mass.	21 Hurd Street
Brown, Russell Lee, Jr., VI, Lowell, Mass.	59 Bradstreet Avenue
Callahan, Daniel Francis, IV, Lowell, Mass.	26 Second Avenue
Carpenter, Bryant Locke, VI, Rockland, Mass.	228 Varnum Avenue
Charatz, Milton, IV, Brooklyn, New York	42 So. Walker Street
Cherowbrier, Edward, Jr., IV., Methuen, Mass.	———
Colman, Alexander Herman, VI, N. Y., N. Y.	77 Livingston Avenue
Davis, James Edward, VI, Toronto, Ontario	173 Nesmith Street
DeAngelis, Louis Paul, VI, Old Forge, Penna.	100 Mt. Washington St.
DeMallie, Stephen Potter, VI, Lowell, Mass.	275 Gibson Street
Downing, Parker Willard, IV, Ayer, Mass.	———
Duffy, Joseph Gordon, VI, Lawrence, Mass.	———
Dulack, Joseph Thomas, Jr., VI, Somersville, Conn.	439 Varnum Avenue
Eliyesil, Mehmet Can, VI, Tarsus, Turkey	392 Chelmsford Street
Feltheimer, Arthur Murray, VI, Bronx, N. Y.	330 Stevens Street
Field, Marvin Joseph, VI, Yonkers, New York	185 Princeton Blvd.
Fishman, Maurice, IV, Roxbury, Mass.	320 Wilder Street
Foley, William Matthew, IV, Lowell, Mass.	120 Fulton Street
Fox, Richard Coleman, VI, Lowell, Mass.	27 Royal Street
Fraser, Richard Warren, VI, Melrose, Mass.	142 Riverside Street
Friedlander, Robert, VI, Brooklyn, New York	39 West Street
Fruchtman, Gerald Gary, VI, Brooklyn, N. Y.	14 Oakland Street
Gardner, Lawrence Carroll, IV, Lowell, Mass.	48 Sutherland Street
Giglio, Frank Antonio, VI, Brooklyn, New York	298 Riverside Street
Gilchrest, Dexter Stuart, VI, Beverly, Mass.	406 Pawtucket Street
Godet, John Russell, IV, Lowell, Mass.	236 Salem Street
Gottlieb, Seymour, VI, Brooklyn, New York	77 Mt. Washington St.
Greenberg, Bernard, III, Brooklyn, New York	417 Wilder Street
Greene, Philip Leon, VI, Brooklyn, New York	77 Livingston Avenue
Gregg, Julian Barnes. VI, Worcester, Mass.	406 Pawtucket Street
Gruber, Phillip Arthur, IV, Lowell, Mass.	57 Corbett Street
Guggenheim, Leopoldo Levi, VI, Santiago, Chile	15 Douglas Road
Gunther, Marilyn Katherine, IV, Dracut, Mass.	———
Hallett, Richard Libby, VI, Lowell, Mass.	98 Wannalancit Street
Handy, William Lafayette, VI, Longmeadow, Mass.	———
Harvey, Clifford Arthur, IV, Lowell, Mass.	36 Woodward Terrace
Haskel, Simon Aaron, VI, Brooklyn, New York	77 Livingston Avenue
Huff, Thomas Augustus, VI, West Coast, B. C.	54 Mt. Grove Street
Illingworth, Sam Groveham, V, West Newton, Mass.	———
Kane, James Francis, VI, Lowell, Mass.	37 Unsworth Street
Kavouras, Christos Nikitas, VI, Lowell, Mass.	5 Hancock Avenue
Keeney, John Henry, VI, Somersville, Conn.	222 Varnum Avenue

Home Address	*Lowell Address*
Kenniston, George Demeritt, IV, Lowell, Mass.	67 Loring Street
King, John Michael, Jr., VI, Lowell, Mass.	158 Howard Street
Kosksal, Lutfu, VI, Istanbul, Turkey	123 Riverside Street
Kosartes, Marina, VI, Lowell, Mass.	1036 Middlesex Street
Krivis, Ernest, VI, Brookline, Mass.	———
Lachut, Herbert Michael, IV, Dracut, Mass.	———
Lapidus, Charles Henry, IV, Brooklyn, N. Y.	77 Livingston Avenue
Lash, Seymour Leon, VI, Brooklyn, New York	14 Oaklands Street
Lent, Roy Gordon, VI, Maynard, Mass.	406 Pawtucket Street
Lesser, Stanley Baker, VI, Brooklyn, New York	239 Stevens Street
Levin, Jordan, VI, Lowell, Mass.	141 East Merrimack St.
Liverant, Manfred Joachim, VI, Quebec, Canada	272 Merrimack Street
Luz, Victor James, VI, Lowell, Mass.	1122 Gorham Street
McCartin, John Peter, VI, Lowell, Mass.	611 Stevens Street
McMahon, Laurence Francis, IV, Lowell, Mass.	7 Belmont Street
Maguire, John Paul, VI, Lowell, Mass.	31 Prospect Street
Manning, Edward Nicholas, IV, Cambridge, Mass.	406 Pawtucket Street
Martin, James Frank, VI, Lowell, Mass.	53 Fay Street
Mendrala, Edward John, II, Thompsville, Conn.	Smith Hall
Mitchell, Alvin Emery, IV, Warwick, R. I.	304 Salem Street
Natter, Sidney, VI, Lowell, Mass.	173 Branch Street
Nystrom, Frederick Walter, VI, W. Chelmsford, Mass.	———
Peirent, Robert John, IV, Dracut, Mass.	———
Pfister, David Herbert, V, Lynbrook, New York	31Wavertly Avenue
Piekarski, William Fabian, IV, Lowell, Mass.	179 Hildreth Street
Pinto, Americo Seabra Moura, VI, Rio de Janeiro, Brazil	392 Chelmsford Street
Polebaum, Eugene Harvey, VI, Brooklyn, N. Y.	52 Princeton Blvd.
Renaux, Ingo Arlindo, VI, Brusque, Brazil	392 Chelmsford Street
Rhodes, Max, IV, Queens, New York	77 Livingston Avenue
Richardson, Donald Forrest, VI, Lowell, Mass.	53 Dunfey Street
Riordan, Warren Paul, Jr., VI, Lowell, Mass.	21 Orchard Street
Rosa, Manuel August, VI, Methuen, Mass.	———
Roy, Raymond Emil, IV, Lowell, Mass.	95 Jenness Street
Sayers, Thomas Martin, VI, Lowell, Mass.	27 Burtt Street
Schwarz, Walter, VI, Elmhurst, L. I., N. Y.	457 Westford Street
Segall, William Martin, IV, Lowell, Mass.	111 Luce Street
Shapiro, Sumner, VI, Lowell, Mass.	37 Canton Street
Shaughnessy, John Andrew, IV, Lowell, Mass.	18 Puffer Street
Sheehan, Charles Russell, IV, Lowell, Mass.	374 Adams Street
Stavrakas, Evangelos, V, Brooklyn, New York	31 Waverly Avenue
Stillman, Edward Issac, VI, Shaker Heights, Ohio	77 Livingston Avenue
Strobel, Richard Irving, IV, Lawrence, Mass.	———
Stroup, John Francis, Jr., IV, Boston, Mass.	304 Salem Street
Sugg, Philip Willson, VI, Lisbon Falls, Maine	406 Pawtucket Street
Sullivan, John Edward, VI, Lowell, Mass.	280 Beacon Street
Sweeney, James William, IV, Lowell, Mass.	318 Adams Street
Trommer, Charles Richard, IV, New York, N. Y.	392 Chelmsford Street
Vomvouras, Paul, VI, Dorchester, Mass.	406 Pawtucket Street
Weinstein, Manuel, VI, Revere, Mass.	142 Riverside Street
Weiser, John Benno, VI, Elmhurst, New York	8 Bagley Avenue
Weiss, Donald Stuart, V, New York, New York	25 Princeton Blvd.
Wilbur, Earl Raymond, IV, Lowell, Mass.	172 Shaw Street
Woodward, Paul Henry, VI, Lebanon, N. H.	392 Chelmsford Street

Home Address	*Lowell Address*
Young, William Arthur, VI, Toronto, Canada	Chelmsford, Mass.
Yumlu, Mustafa Ekrem, VI, Istanbul, Turkey	35 Varnum Avenue

Class of 1950

Abbott, George Amos, II, Lowell, Mass.	466 Bridge Street
Adler, Kenneth Myron, VI, Brooklyn, New York	306 Wilder Street
Andrews, Hugh Hill, VI, Andover, Mass.	———
Angelo, Paul Joseph, Jr., VI, Lowell, Mass.	50 Woodward Avenue
Augsburger, Gerardo Rainer, I, Buenos Aires,	59 Arlington Street
Argentina	———
Becker, Richard John, I, Lowell, Mass.	58 13th Street
Besso, Michael Maurice, IV, Brooklyn New York	109 Mammoth Road
Blagman, Burton, IV, Brooklyn, New York	77 Livingston Avenue
Bonczar, Thaddeus Joseph, VI, Lowell, Mass.	130 Jewett Street
Book, Bernard Samuel, III, Bronx, New York	263 Princeton Blvd.
Boudreau, Paul Victor, IV, Lowell, Mass.	295 Riverside Street
Bowden, Alanson Walker, Jr., II, Rumford, Maine	Stow, Mass.
Breck, Wendell Herbert, II, Dracut, Mass.	———
Bressler, Sidney Wallace, V, Brockton, Mass.	52 Princeton Blvd.
Brown, Judith Anne, IV, Georgetown, Mass.	John Street
Brown, Walter Madison, II, Worvester, Mass.	34 Arlington Street
Brownell, Sumner Ives, I, Moodus, Conn.	262 Pawtucket Street
Brunelle, Norman Matthew, IV, Fitchburg, Mass.	392 Chelmsford Street
Callan, Stephen Smith, VI, Reading, Mass.	———
Canova, Alfred William, VI, Holyoke, Mass.	31 Waverly Avenue
Carter, Fred Dolge, III, Millbury, Mass.	31 Waverly Avenue
Casey, John Gerard, VI, Pittsfield, Mass.	406 Pawtucket Street
Casey, Thomas Garrett, IV, Lowell, Mass.	8 Gates Street
Castoriano, Claude Emmanuel, I, Lima, Peru	272 Merrimack Street
Chadwick, Thomas Neilson, VI, Lowell, Mass.	57 Robbins Street
Chao, Pei Chung, I, Shanghai, China	12 Warwick Street
Clifford, Stanley Joseph, II, West Roxbury, Mass.	406 Pawtucket Street
Cohen, Stanley Robert, VI, Newton Highlands,	32 Orchard Street
Mass.	———
Commerford, Therese Rita, IV, Lowell, Mass.	29 Starbird Street
Copp, Albert Raymond, IV, Hudson, Mass.	———
Cummings, Robert Edward, VI, Enfield, Conn.	406 Pawtucket Street
Derby, James Henry, II, Lawrence, Mass.	———
Douglas, Warren Dana, VI, Lowell, Mass.	30 Burgess Street
Durbin, Paul, VI, Worcester, Mass.	59 Arlington Street
Earls, Robert Kimball, VI, Southbridge, Mass.	406 Pawtucket Street
Ellis, Lawrence Francis, II, Melrose, Mass.	406 Pawtucket Street
Ellis, Ralph Jefford, VI, Marshfield Hills, Mass.	752 Andover Street
Evans, John, IV, E. Boston, Mass.	31 Waverly Avenue
Evans, William George, IV, East Boston, Mass.	697 Bridge Street
Farley, Glenn Robert, VI, North Andover, Mass.	———
Feinman, Jerome Herold, VI, New York, N. Y.	32 Orchard Street
Feldman, Manuel David, V, Lynn, Mass.	320 Wilder Street
Feyler, Donald Pearson, IV, Chelmsford, Mass.	———
Feyler, Irving Wyman, Jr., IV, Chelmsford, Mass.	———
Fifield, Richard Tyler, VI, Melrose, Mass.	———
Fillmore, Malcolm Graham, Jr., VI, Melrose,	Nashua, N. H.
Mass.	———
Fishback, Joseph, V, Rockaway Beach, New York	77 Livington Avenue

Home Address	*Lowell Address*
Fleisher, Conrad Gerald, IV, Watertown, Conn.	77 Livington Avenue
Flister, Walter Edwin, IV, Hyde Park, Mass.	31 Waverly Avenue
Fowle, Frederick Jordon, II, Wellesley, Mass.	31 Waverly Avenue
Fox, Julius Ira, VI, Philadelphia, Penn.	55 Huntington Street
Gaidis, Leo Peter, IV, Lawrence, Mass.	———
Gaon, Harry, VI, Montreal, Canada	77 Livington Avenue
Gellis, Donald Ian, VI, Laurelton, New York	53 Mt. Hope Street
Glass, Arthur Marvin, VI, Providence, R. I.	53 Mt. Hope Street
Glassman, Herbert, II, Brighton, Mass.	272 Merrimack Street
Goldman, Alfred Yale, V, Chelsea, Mass.	———
Goldman, Sumner Bernard, I, Roxbury, Mass.	12 Warwick Street
Gouveia, Adelino Peter, IV, Lowell, Mass.	161 Lawrence Street
Gregg, Joan Louise, IV, Lowell, Mass.	1867 Middlesex Street
Grochmal, Stanley Joseph, IV, Lowell, Mass.	46 Albion Street
Hacker, Morton, VI, Lowell, Mass.	7 Rockdale Avenue
Halligan, Raymond Earl, IV, Lowell, Mass.	47 Barclay Street
Hekker, Frank Henry, IV, Rutherford, N. J.	406 Pawtucket Street
Herbert, Erwin Lori, VI, Elizabeth, N. J.	272 Merrimack Street
Higgins, William Eugene, VI, Lowell, Mass.	69 Newhall Street
Higuera, Cristobol Hernandez, II, Mexico	141 Summer Street
Hornyak, Frederick Mathew, IV, Philadeplphia,	Dracut, Mass.
Penna.	———
Kaufman, David Leonard, II, Brooklyn, New York	100 Mt. Washington St.
King, Richard McClain, VI, Shawnee, Oklahoma	272 Merrimack Street
Koffman, Leonard Saunders, III, Boston, Mass.	392 Chelmsford Street
Kormos, Peter Marion, V, Lowell, Mass.	205 Stackpole Street
Koshak, Daniel Theodore, IV, Lowell, Mass.	262 Adams Street
LaRiviere, Stephen Gerard, III, Southbridge,	28 Fourth Street
Mass.	84 Methuen Street
Laureti, Remo Joseph, VI, Quincy, Mass.	———
Lebowitz, Myer, VI, Boston, Mass.	84 Methuen Street
Leitgeb, Donald Joseph, V, Waldwick, N. J.	406 Pawtucket Street
Lemire, Gabrielle Marie, IV, Lowell, Mass.	52 Colonial Avenue
Levinson, Arthur David, VI, Brooklyn, New York	77 Livingston Avenue
Liberty, William Wallace, VI, Quechee, Vermont	799 Merrimack Street
Lord, Edwin Lincoln, Jr., VI, W. Medford, Mass.	Smith Hall
McCarron, Dorothy Anne, IV, Lowell, Mass.	416 Rogers Street
McGowan, Malcolm, IV, Lowell, Mass.	55 Marlborough Street
Mahoney, Herbert Francis, IV, Winchester, Mass.	406 Pawtucket Street
Majeune, Gaston Christian, IV, Haverhill, Mass.	272 Merrimack Street
March, Peyton Conway, VI, Lowell, Mass.	30 West Sixth Street
Mark, Regina, III, Baltimore, Maryland	50 John Street
Matlin, Nathaniel Abraham, IV, Long Beach,	48 Gates Street
New York	———
Meltzer, Richard Morris, VI, New York, N. Y.	272 Merrimack Street
Merrill, Allen Robert, VI, Tewksbury, Mass.	———
Middleton, Donald Whiting, VI, Rehoboth, Mass.	12 Crawford Street
Milgrim, Seymour, V, Brooklyn, New York	Smith Hall
Miller, James Edward, IV, Leavenworth, Kansas	12 Crawford Street
Morrison, Robert Eugene, IV, Dracut, Mass.	———
Newman, Jerome Leonard, VI, Brooklyn, N. Y.	32 Dover Street
O'Donoghue, John Francis, Jr., II, Belmont, Mass.	406 Pawtucket Street
O'Krafka, Alfred Ernest, II, Hespeler, Ontario	75 Smith Street
Paul, Vito John, VI, Lawrence, Mass.	———
Peterson, John Samuel, VI, Andover, Mass.	———

Home Address	*Lowell Address*
Pong, William, I, Pine Bluff, Arkansas	137 Riverside Street
Priestley, Joseph Amos, VI, Lowell, Mass.	8 Gage Avenue
Profio, Samuel Camillo, IV, Lowell, Mass.	1878 Middlesex Street
Proulx, Raymond Elphege, III, Lowell, Mass.	17 Dodge Street
Ramsbottom, John Dana, Jr., I, Fall River, Mass.	406 Pawtucket Street
Rawitz, Leonard, VI, Roxbury, Mass.	392 Chelmsford Street
Rebenfeld, Ludwig, IV, Jackson Heights, N. Y.	263 Princeton Blvd.
Reines, William, IV, Poughkeepsie, N. Y.	272 Merrimack Street
Rivollier, Elie, Jr., V, Clinton, Mass.	Smith Hall
Rodgers, Charles Joseph, Jr., IV, Lowell, Mass.	14 Dumerle Street
Rudes, Sidney, V, Brooklyn, New York	Smith Hall
Rudolf, Michell, Joseph, VI, Lowell, Mass.	5 Hazel Square
Ruffenach, Stephen Clifford, IV, Paterson, N. J.	285 Foster Street
Samdperil, Albert, VI, Providence, R. I.	392 Chelmsford Street
Sampson, Walter Stewart, Jr., VI, Belmont, Mass.	———
Sheroff, Robert Murray, I, Dorchester, Mass.	———
Shires, William Stanley, VI, Lowell, Mass.	18 Gage Avenue
Sloan, Robert Hood, VI, Tewksbury, Mass.	———
Smaha, Herbert Joseph, IV, Methuen, Mass.	———
Snow, Ralph Frank, VI, Montreal Quebec	752 Andover Street
Sosebee, Donald Winston, II, Newport, N. H.	31 Waverly Avenue
Spicer, George William, IV, Lowell, Mass.	19 Rhodora Street
Struzik, Frank Broneslaw, VI, Woonsocket, R. I.	98 Stevens Street
Sweetser, Paul Ashton, VII, North Yuincy, Mass.	Dracut, Mass.
Tattersall, James, VI, West Roxbury, Mass.	———
Teubal, Michael Neville, II, Buenos Aires, Argentina	222 Varnum Avenue
Volin, Irwin Jack, II, Lawrence, New York	452 Fletcher Street
Webster, Charle: Clifford, VI, Lowell, Mass.	225 Foster Street
Weiner, Charles Richard, III, Brooklyn, N. Y.	77 Livingston Avenue
Welcome, William Francis, IV, Lowell, Mass.	105 Lauriat Street
Weldon, Joseph Edward, IV, Lowell, Mass.	72 Lafayette Street
West, Albert George, VI, Whitinsville, Mass.	406 Pawtucket Street
Whitehead, Charles Andrew, I, Dover, N. J.	31 Waverly Avenue
Williams, John Woodburn, II, Perth, Ontario, Can.	406 Pawtucket Street
Wirth, Allan Robert, IV, Lawrence, Mass.	———
Woidzik, Albert Thomas, VI, Pringle, Penna.	392 Chelmsford Street

Class of 1951

Abbot, Edward Moseley, II, Wesford, Mass.	———
Abrahamson, David Marshall, III, Worcester, Mass.	100 Mt. Washington St. ———
Aronowitz, Marvin, VI, Paterson, New Jersey	42 South Walker Street
Athas, Stanley Theodore, VI, Lowell, Mass.	138 Bowers Street
Bazakas, Apostolos Christos, VI, Marlboro, Mass.	37 Varney Street
Belsik, Paul Harold, VII, Averne, New York	77 Livingston Avenue
Berwick, Robert Lloyd, VI, Meridan, Conn.	77 Livingston Avenue
Bickford, Robert Donald, II, Readfield, Maine	84 Bellvue Street
Bischoff, Frederick Bedell, VI, Wilmington, Mass.	———
Bloomenfeld, Joseph, VI, Brooklyn, New York	Bedford, Mass.
Boghosian, Nishan, VI, Whitinsville, Mass.	31 Waverly Avenue
Brosnan, Martin John, IV, Lowell, Mass.	20 Genest Avenue
Brown, Frederick Donald, IV, Lowell, Mass.	24 Viola Street
Buchanan, Warren Thomas, VI, North Chelmsford, Mass.	———

Home Address	*Lowell Address*
BULLOCK, ROBERT JOSEPH, VI, Arlington, Mass.	———
BURNS, EDWARD CHARLES, IV, Lowell, Mass.	511 Westford Street
BUSH, NORMAN FITZ, II, Dresden, Ohio	Nabnassett, Mass.
BUSSIERE, ROBERT WILLIAM, III, Pittsfield, Mass.	Smith Hall
CASSIDY, PAUL CONLON, IV, Lowell, Mass.	182 Wentworth Avenue
CATE, ALFRED LOUIS, IV, Lawrence, Mass.	———
CHACE, WILLIAM GEORGE, JR., VI, Wesford, Mass.	———
CHAREWICZ, JOSEPH HENRY, VI, Lawrence, Mass.	———
CHURCHVILLE, JOSEPH JOHN, II, Townsend, Mass.	406 Pawtucket Street
COOMBES, RICHARD WILLIAM, VI, Tewksbury, Mass.	———
CORCORAN, HENRY JAMES, JR., II, Newton Lower Falls, Mass.	53 Mt. Hope Street
COTTRELL, ROBERT CHARLES, IV, Lowell, Mass.	103 South Walker Street
COVINGTON, FREDERICK ARTHUR, IV, Lowell, Mass.	1268 Middlesex Street
CRAVEN, FRANCIS JOSEPH, JR., IV, Lowell, Mass.	620 School Street
CREEGAN, ROBERT MICHAEL, IV, Lowell, Mass.	31 Morey Street
CROCKFORD, GEORGE WILLIAM, JR., IV, Fichburg, Mass.	28 Riverside Street
CUSHMAN, PAUL SWAN, VI, Glens Falls, New York	Smith Hall
DAVEAU, NORMAN OLIVER, I, Webster, Mass.	406 Pawtucket Street
DAVIS, EVANS READE, VI, Toronto, Ontario, Can.	16 Tyler Park
DENIO, RUTH ELINOR, IV, Lowell, Mass.	129 B. Street
DESCHAMPS, JOSEPH RAYMOND, VI, Lawrence, Mass.	———
DESCOTEAUX, PAUL MAURICE, VI, Lowell, Mass.	104 Cabot Street
DOOLEY, DONALD DAVID, IV, Lowell, Mass.	799 Chelmsord Street
DUCHARME, JOSEPH JAMES, IV, Lowell, Mass.	166 Smith Street
DUNCAN, BLAIR ROBERTSON, IV, Easthampton, Mass.	Textile Avenue
DUPUIS, AMEDEE JAMES, VI, Lowell, Mass.	26 Fremont Street
DURGIN, BERTRAND HORACE, IV, Lowell, Mass.	12 Crane Street
EKLUND, CLINTON LOUIS, VI, Lowell, Mass.	137 Midland Street
FAVRO, GILBERT JAMES, IV, Lowell, Mass.	19 Potter Street
FEITELSON, HERBERT WILLIAM, VI, New York, N. Y.	53 Mt. Hope Street
FERRON, RICHARD EDWARD, VI, Belmon, Mass.	———
FINKLESTEIN, MARTIN ISAAC, IV, Paterson, N. J.	392 Chelmsford Street
FITZGERALD, ROBERT ANTOIN, VI, Belmont, Mass.	———
FREEMAN, ROBERT HERBERT, IV, Brooklyn, N. Y.	452 Fletcher Street
FRENCH, GERALD WILLIAM, VI, Lowell, Mass.	55 Varnum Street
GILMAN, LEONARD IRWIN, IV, Dorchester, Mass.	———
GIRARD, ROGER DONALD, V, Lowell, Mass.	243 White Street
GIROUARD, PAUL CHARLES, VI, Boston, Mass.	Smith Hall
GLIDDEN, JOHN EDWIN, II, Beverly, Mass.	100 Mt. Washington St.
GOLDBERG, MURRAY MYLES, VI, Manchester, N. H.	77 Livingston Avenue
GOODWIN, DORRANCE HAVEN, VI, Sanford, Maine	Westford, Mass.
GORECKI, CHARLES EDWARD, VI, Haverhill, Mass.	———
GOULEKAS, CHARLES ANDREW, VI, Lowell, Mass.	67 Varney Street
GOUVEIA, SERAPHIN ANTHONY, IV, Lowell, Mass.	161 Lawrence Street
GREENBERG, GERALD MARK, IV, Brooklyn, New York	417 Wilder Street
GUIDOTTI, ALFRED EDWARD, II, Uxbridge, Mass.	31 Waverly Avenue
GUNTHER, ELIZABETH LORRAINE, IV, Dracut, Mass.	———
HALEY, PHILIP WESLEY, VI, Quincy, Mass.	46 Thirteenth Street
HALPERN, MELVIN ARTHUR, VI, New York, N. Y.	77 Livingston Avenue
HAYES, JOHN THOMAS, V, Cambridge, Mass.	———
HIGGINS, THOMAS DAVID, VI, Milton, Mass.	———
HIRSCHHORN, GERARD, VI, Brooklyn, New York	187 Textile Avenue
HOCHBERG, EDWARD GEORGE, VI, Paterson, N. J.	50 Standish Street

Home Address	*Lowell Address*
Holmberg, Harry Harmon, VI, Milford, Mass.	31 Waverly Avenue
Hoyle, Robert Henry, IV, Chelmsford, Mass.	———
Jackle, Roger Williams, II, Springfield, Gardens, N. Y.	31 Waverly Avenue
Johnson, Paul Lester, VI, Dorchester, Mass.	250 W. Meadown Road
Karpoff, David, II, New York, New York	173 Branch Street
Keith, Richard Canover, I, Putnam, Conn.	137 Wentworth Avenue
Kelleher John James, IV, Lowell, Mass.	14 Prince Terrace
Kelley, Edward Francis, II, No. Billerica, Mass.	———
Knight, John Henry, II, Billerica, Mass.	———
Kohnfelder, Charles Harry, VI, Springfield, Mass.	392 Chelmsford Street
Kosowicz, Walter John, IV, Lowell, Mass.	5 Jewett Street
Labrecque, Leo Eugene, IV, Lawrence, Mass.	———
Landis, Melvin Bernard, VI, Springfield, Mass.	117 Grand Street
Latkowitch, Sydney Abraham, VI, Chelsea, Mass.	———
Lawson, Wayne Herbert, IV, Lowell, Mass.	12 Puffer Street
Levenson, Albert Milton, IV, Mattapan, Mass.	Smith Hall
Linberg, Charles Francis, VI, Carney's Point, N. J.	Smith Hall
Little, Charles Abbott, III, Winthrop, Mass.	137 Riverside Street
Luba, Marvin, VI, New York, New York	272 Merrimack Street
Lyons, Allan Stuart, VI, New York, New York	417 Wilder Street
McKone, Henry James, VI, Lowell, Mass.	27 Woodward Avenue
McKone, Thomas Joseph, IV, Dracut, Mass.	———
McKone, Vincent Joseph, IV, Lowell, Mass.	29 Orleans Street
Maguire, Thomas Joseph, VI, Lowell, Mass.	31 Prospect Street
Menzies, William Cornet, Jr., VI, Adams, Mass.	31 Waverly Avenue
Merrill, George Leslie, IV, Lowell, Mass.	2026 Middlesex Street
Merrill, Kenneth Stephen, VI, Lowell, Mass.	364 Varnum Avenue
Miller, Arthur Paul, VI, Salt Lake City Utah	137 Riverside Street
Miller, Kenneth Edward, II, Lawrence, Mass.	64 Mt. Hope Street
Monaco, Albert Thomas, VI, Quincy, Mass.	84 Methuen Street
Morris, Edward Sharon, III, Paterson, N. J.	422 Pine Street
Mountain, Harold Ronald, II, Dexter, Maine	31 Waverly Avenue
Murmes, Leonard, II, Brighton, Mass.	———
Murphy, Roger James, VI, North Uxbridge, Mass.	31 Waverly Avenue
Murphy, Stuart Tower, VI, Tewksbury, Mass.	———
Needle, Irvin R., III, Brooklyn, New York	422 Pine Street
Newell, Kenneth Bernard, VI, Troy, New York	Smith Hall
Nickerson, Earl James, V, Chelmsford, Mass.	———
Noonan, Joseph Donald, IV, Lowell, Mass.	35 Forest Street
O'Donnell, William Robert, VI, Lowell, Mass.	11 Hazeltine Street
Panto, Joseph Salvator, IV, Lawrence, Mass.	64 Mt. Hope Street
Pantell, Ira Harry, III, New York, New York	77 Livingston Avenue
Patrick, Kit Carson, III, Andover, Mass.	———
Pelliccione, Gregory Joseph, IV, Lawrence, Mass.	———
Peters, Margaret Jean, IV, Lowell, Mass.	163 Fort Hill Avenue
Pihl, Donald Greenwood, VI, Lowell, Mass.	11 Stromquist Avenue
Pofcher, Wilmer, III, Lowell, Mass.	376 Westford Street
Quinn, Raymond John, IV, Lowell, Mass.	314 Wentworth Avenue
Reilly, Frank Thomas, I, Maplewood, N. J.	15 Douglas Road
Roberts, Richard Seymour, VI, Brooklyn, N. Y.	77 Livingston Avenue
Robson, Daniel Riggs, III, Lowell, Mass.	577 School Street
Rosenkrantz, Stanley, I, Pottsville, Penna.	77 Livingston Avenue
Rostler, Seymour Stone, VII, Lowell, Mass.	31 Holden Street

Home Address	*Lowell Address*
Rowe, Peter Marcell, III, Paterson, New Jersey	Smith Hall
Ryan, Laurence Francis, Jr., VI, Carney's Point, N. J.	30 Riverside Street
Salomon, Jay Stuart, VI, Brooklyn, New York	39 Dover Street
Schlaginhaufen, Eric Alan, IV, North Bergen, N. J.	143 Upham Street
Schrager, Jerome Stanley, V, Brooklyn, N. Y.	800 Merrimack Street
Seigel, Hersch David, II, Brokkline, Mass.	———
Shapley, Harvey David, VI, Great Neck, N. Y.	77 Livingston Avenue
Shaughnessy, Robert Kenton, IV, Lowell, Mass.	18 Puffer Street
Sherburne, Edwin Collier, IV, Tyngsboro, Mass.	———
Sheroff, Melvin S., VI, Dorchester, Mass.	———
Silver, Bernard, III, Worcester, Mass.	25 Princeton Blvd.
Socransky, Morris Harvey, II, Mount Royal, Quebec	272 Merrimack Street
Solov, Leonard, II, Newton Center, Mass.	287 Stevens Street
Spencer, Robert Weeks, II, Saylesville, R. I.	37 Varney Street
Squire, Charles, VI, Glen Cove, New York	64 Tyler Park
Stein, Alfred Eugene, VI, Astoria, L. I., N. Y.	77 Livingston Avenue
Sternlieb, Herschell, V, Brighton, Mass.	Smith Hall
Sumers, Robert Warren, IV, San Diego, California	Chelmsford Street
Swiatek, Henry John, IV, Methuen, Mass.	———
Terris, John Henry, Jr., IV, Norh Billerica, Mass.	———
Teta, Walter Michael, III, Brooklyn, New York	299 Princeton Blvd.
Traversy, Adolphe Arthur, IV, Lowell, Mass.	103 Ennell Street
Trilling, Theodore R., Jr., II, Woodmere, N. Y.	287 Stevens Street
Tully, Donald Bernard, IV, Lowell, Mass.	249 Third Street
Tully, Francis Paul, IV, Lowell, Mass.	24 Light Avenue
Tully, Paul Raymond IV, Lowell, Mass.	249 Third Street
Tung, Cheng-Yu, I, Shanghai, China	56 Fouth Avenue
Wang, James Paul, VI, Shanghai, China	30 White Street
Weldon, Arthur Joseph VI, Lowell, Mass.	53 Warwick Street
Whitney, Kenneth, II, Pittsfield, Mass.	37 Varney Street
Whitworth, James Webster, IV, Chelmsford, Mass.	———
Wiener, Donald, IV, New Britain, Connecticut	32 Mt. Washington St.
Wilkinson, John Stewart, VI, North Andover, Mass.	———
Wood, Samuel Anthony, IV, North Adams, Mass.	152 Grove Street
Wolf, Melvin Lawrence, VI, Troy, New York	77 Livingston Avenue

Class of 1952

Aldrich, Donald Winthrop, III, North Tewksbury, Mass.	———
Allen, Curtis Carleton, II, Milton, Mass.	Smith Hall
Allison, John Harold, VI, North Andover, Mass.	———
Ames, Irwin Maxwell, VI, Brooklyn, New York	Smith Hall
Aptaker, Erwin Malcolm, VII, Revere, Mass.	———
Aronson, Richard Lee, V, Great Neck, New York	Smith Hall
Arsham, Martin David, II, Cleveland Heights, Ohio	Smith Hall
Axon, Gordon Lyle, IV, Chelmsford, Mass.	———
Barry, Gerald Francis, IV, Lowell, Mass.	262 Adams Street
Bauer, James Stephen, VI, Waterloo, Ont., Canada	Smith Hall

Home Address	*Lowell Address*
Beaulier, Vernon James, IV, North Billerica, Mass.	———
Becker, Marvin Franklin, II, Brooklyn. N. Y.	Smith Hall
Becker, Robert Ivan, VI, Leicester, Mass.	Smith Hall
Belanger, Wilfred Edmond, IV, Lowell, Mass.	18 Fisher Street
Bell, Gilbert Carter, VI, Lowell, Mass.	71 Robbins Street
Bellida, Andrew Henry, IV, Graniteville, Mass.	———
Benjamin, Albert, III, Brooklyn, New York	Smith Hall
Bernstein, Milton Jacob, III, Paterson, N. J.	Smith Hall
Bethel, Charles Huggard, V, Great Neck, N. Y.	Smith Hall
Bird, Marshall Coles, II, Rochester, N. H.	Smith Hall
Boches, Milton, IV, Haverhill, Mass.	———
Bodall, Gilbert Ronald, VI, Pawtucket, R. I.	Smith Hall
Boder, Stephen Joseph, VI, Lynn, Mass.	Smith Hall
Brewer, Kenneth Harvey, II, Manchester, N. H.	Smith Hall
Brissette, Richard Stacy, VI, Rockport, Illinois	Smith Hall
Bromley, John E., VI, Glenside, Pennsylvania	Smith Hall
Brown, Ellwood Thomas, VI, Grafton, Mass.	Smith Hall
Brown, Harold Stacy, VI, West Warwick, R. I.	Smith Hall
Brown, Perry Horton, VI, Marblehead, Mass.	Smith Hall
Bussiere, Kirk, III, Pittsfield, Mass.	Smith Hall
Carney, Philip Dowling, II, Dedham, Mass.	Smith Hall
Carroll, William Henry, III, Medford, Mass.	Smith Hall
Claridge, Arthur Whittier, VI, Marlboro, Mass.	Smith Hall
Clark, George, VI, Holyoke, Mass.	25 Lawrence Street
Coffin, Laurance Gregory, VII, Port Chester, New York	Smith Hall
Daly, John Francis, VI, Lowell, Mass.	118 West Sixth Street
Delaney, Frances Lawrence, VI, Forge Village, Mass.	———
Dersh, Harvey Arthur, VI, Brooklyn, New York	Smith Hall
Desrochers, Roland Joseph, II, Franklin, N. H.	Smith Hall
Dexter, Daniel William, IV, West Chelmsford, Mass.	———
Dickison, Bruce Osborne, IV, Lowell, Mass.	48 E Street
Dickson, Clifford Russell, VI, Saylesville, R. I.	Smith Hall
Donoian, Haig Cadmus, IV, Lowell, Mass.	44 Elm Street
Draper, Richard Leonard, I, Hopedale, Mass.	Smith Hall
Drinkwater, Wayne Bryant, VI, Rockland, Maine	Smith Hall
Dwyer, Robert Leonard, VII, Watertown, Mass.	———
Eklund, Richard Thorp, VI, Dracut, Mass.	———
Engel, Richard Brom, V, Elmhurst, L. I., N. Y.	Smith Hall
Engelhardt, Bernard Herbert, VI, Brooklyn, New York	Smith Hall
Feinberg, Bertram, III, Forest Hills, New York	Smith Hall
Finegold, Donald Erwin, V, Peabody, Mass.	Smith Hall
Finnerty, Frank, IV, Lowell, Mass.	144 Winthrop Avenue
Fisher, Edward Capel, II, Mamaroneck, N. Y.	100 Mt. Washington St.
Freeman, Robert James, VII, Chicago, Illinois	Smith Hall
Fulginiti, P. Samuel, VI, Worcester, Mass.	Smith Hall
Galas, Allron Henry, VI, Monson, Mass.	Smith Hall
Gale, Norman Donald, VII, St. Louis Missouri	422 Pine Street
Gellene, Alfred Vincent, V, Paterson, N. J.	Smith Hall
Giard, Edward Henry, IV, Peterboro, N. H.	Smith Hall

Home Address	*Lowell Address*
Gilmore, Anne Elizabeth, V, Lowell, Mass.	101 Vernon Street
Ginsburg, Alan, IV, Brooklyn, New York	Smith Hall
Gladstone, Milton Harvey, V, Brooklyn, N. Y.	Smith Hall
Goulart, Richard Francis, II, Cambridge, Mass.	———
Goven, Earl Joseph, I, Wauregan, Connecticut	Smith Hall
Grady, Douglas Francis, I, Palisades Park, N. J.	201 White Street
Graham, Everett Henderson, VI, Graniteville, Mass.	———
Greeley, Richard Francis, VI, Chelmsford, Mass.	———
Greenwood, Alden True, VI, Billerica, Mass.	———
Grill, Joel Harvey, VI, Brooklyn, New York	Smith Hall
Haddad, Herbert Lawrence, VI, Iselin, N. J.	Smith Hall
Harty, William Francis, Jr., IV, Pawtucket, R. I.	Smith Hall
Hixon, Wesley Francis, I, Hopedale, Mass.	Smith Hall
Hochfeld, Michael, IV, Bronx, New York	Smith Hall
Hochner, Walter Leo, IV, Kew Gardens, N. Y.	Smith Hall
Hocking, Winfred Thomas, VI, Melrose, Mass.	Smith Hall
Hurst, Robert Hodgson, VI, West Newton, Mass.	Smith Hall
Ivanowicz, Michael, III Blackstone, Mass.	Smith Hall
Jaciuk, Donald Anthony, VI, Lowell, Mass.	56 West Fourth Street
Jackson, Alfred Lee, V, Cumberland, Maryland	Smith Hall
Jouret, John Edward, II, Andover, Mass.	Smith Hall
Judge, Henry Bernard, IV, Lawrence, Mass.	———
Kalantzakos, Nicholas, VI, Lowell, Mass.	44 Adams Street
Kaye, Irwin Richard, VII, Brookline, Mass.	Smith Hall
Kaye, Michael Brady, V, Watertown, New York	Smith Hall
Keenan, Ursula Frances, III, South Boston, Mass.	90 Riverside Street
Kelleher, Robert Ralph, VI, Arlington, Mass.	Smith Hall
Khoury, Ernest Joseph, IV, Lawrence, Mass.	———
Komins, Burton Louis, IV, Brookline, Mass.	Smith Hall
Koza, Walter Mitchell, VI, Lowell, Mass.	152 Lakeview Avenue
Kupferman, Arthur, VI, Bronx, New York	Smith Hall
Lanciault, George Ernest, IV, Ware, Mass.	Smith Hall
Langlais, Roger John, IV, Lowell, Mass.	48 Riverside Street
LaPlante, Richard Haynes, IV, Lowell, Mass.	31 Eleventh Street
Lein, Sherman, IV, Brooklyn, New York	Smith Hall
Lemire, John Emile, II, Lowell, Mass.	52 Colonial Avenue
Levenson, Richard Norman, VII, Brookline, Mass.	Smith Hall
Levy, Simon, V, Brooklyn, New York	Smith Hall
Lewis, Francis Augustus, VI, E. Dedham, Mass.	Smith Hall
Lewis, Roger Alan, VI, Chelmsford, Mass.	
Liacopoulos, Nicholas C., VI, Lowell, Mass.	185 Mt. Vernon Street
Liston, Florence Patricia, IV, Lowell, Mass.	28 Bellevue Street
Longbottom, Parker Wyman, IV, Claremont, N.H.	Smith Hall
Lynch, William Paul, VI, Lowell, Mass.	85 Sherman Street
McCartney, Donald James, IV, Lowell, Mass.	76 Cambridge Street
McEwen, Thomas Arthur, II, Webster, Mass.	Smith Hall
McKeon, Richard Francis, VI, North Adams, Mass.	18 Fourth Street
McKniff, Francis, VI, Forge Village, Mass.	
MacLean, Harold John, VI, Lowell, Mass.	118 Myrtle Street
McNulty, Denis Michael, II, Dorchester, Mass.	
Mack, Charles Harris, VII, Portland, Maine	50 Standish Street
Madans, Jerome Irwin, I, New York, New York	Smith Hall

Home Address	*Lowell Address*
Mathewson, Robert Earl, VII, Cranston, R. I.	Smith Hall
Meehan, David Justin, I, Providence, R. I.	Draper Street
Merrill, Russell Winn, VI, Chelmsford, Mass.	
Mettler, Edward, VI, Queens, New York	Smith Hall
Michalowski, Kadzimiez Sylvester, II, N. Bellingham, Mass.	Smith Hall
Mills, Harold George, I, Auburn, Maine	Smith Hall
Montgomery, Richard Howlett, VI, Chelmsford, Mass.	———
Morris, Joseph Charles, VI, Long Beach, N. Y.	Smith Hall
Moynahan, Jane Helen, IV, Lowell, Mass.	96 Glenwood Street
Mulcahy, Richard John, II, Brookline, Mass.	Smith Hall
Mullen, Arthur Leo, II, Albany, New York	454 Andover Street
Nelson, Charles David, III, Groveland, Mass.	———
Nestervich, Michael, III, Claremont, N. H.	Smith Hall
Norman, William Arthur, VI, Hopedale, Mass.	Smith Hall
Obdens, Richard Francis, III, Tewksbury, Mass.	———
O'Brien, John William, VI, Winooski, Vermont	Smith Hall
O'Brien, William John, VI, Lowell, Mass.	115 Humphrey Street
O'Donnell, John Thomas, IV, Lowell, Mass.	11 Hazeltine Street
O'Donnell, Roger Joseph, VII, Dorchester, Mass.	Smith Hall
O'Leary, Thomas Francis, VI, Belmont, Mass.	Smith Hall
Olney, Robert Albert, IV, Forest Hills, L.I., N.Y.	Smith Hall
Pecci, Raymond Peter, IV, Lawrence, Mass.	———
Perez, Hernando-D'caro, II, Columbia, S. A.	800 Merrimack Street
Peterson, Douglas John, VI, West Chelmsford, Mass.	———
Pihl, Carl Frederick, IV, Henniker, N. H.	Smith Hall
Platnick, Leonard Howard, II, Brooklyn, N. Y.	Smith Hall
Platt, James Rudman, VI, West Sand Lake, N. Y.	Smith Hall
Polak, Frank Walter, VII, Lowell, Mass.	552 Merrimack Street
Prudenti, Joseph John, VII, Boston, Mass.	———
Randall, Thomas Henry, IV, Chelmsford, Mass.	———
Richard, Alfred Joseph, IV, Gardner, Mass.	Smith Hall
Robey, Robert Versal, IV, Chelmsford, Mass.	———
Rogers, Miriam Ruth, VI, Brooklyn, New York	236 Mammoth Road
Roth, Irwin J., VI., Forest Hills, L. I., N. Y.	Smith Hall
Rottenberg, Ira M., VI, New York, New York	Smith Hall
Roux, Joseph Alexander, IV, Lowell, Mass.	30 Second Avenue
Rubin, Paul Francis, VII, Chelsea, Mass.	———
Ruta, Stanley Anthony, V, Lowell, Mass.	10 May Street
Rutledge, Robert John, Jr., VI, Lowell, Mass.	Andover Street
Ryan, William Eugene, VII, Rankin, Illinois	Dracut, Mass.
Salevitz, Jack, III, Brooklyn, New York	Smith Hall
Santos, Daniel, V, Lowell, Mass.	77 Norcross Street
Sargent, John Wahlers, IV, North Chelmsford, Mass.	———
Scagos, George Angeles, IV, Lowell, Mass.	19 Eighth Avenue
Schaaf, Donald John, IV, Fair Lawn, New Jersey	Smith Hall
Schuster, Raymond Hector, Jr., II, Franklin, Mass.	Smith Hall
Scott, Wemyss Ballentine, Jr., III, Rochester, N. H.	Smith Hall
Shippee, Fred Boswell, IV, Danielson, Connecticut	102 Fremont Street
Simmons, Robert Arthur, IV, Lowell, Mass.	897 Westford Street
Singer, Eric, VI, New York, New York	Smith Hall

Home Address	*Lowell Address*
Smoler, Avrum David, III, New York, New York	Smith Hall
Soumis, Francois, VI, Trois-Rivieres, Quebec, Canada	Smith Hall
Stanton, Joseph Michael, Jr., VI, Tewksbury, Mass.	———
Stein, Harold Murray, VI, Lowell, Mass.	392 Chelmsford Street
Stone, Harold Richard, II, Mattapan, Mass.	Smith Hall
Swanson, Morris Harvey, VI, Westford, Mass.	———
Szczepanik, Henry Myron, IV, Lowell, Mass.	165 Jewett Street
Taylor, Jean Phylis, IV, Lowell, Mass.	316 Pine Street
Tessler, Ramon Norman, VII, Flushing, L. I., N.Y.	Smith Hall
Therrien, Bernard Edmund, IV, North Adams, Mass.	12 Crawford Street
Tosone, Mario Carmen, IV, Lawrence, Mass.	———
Towne, Warren Edward, V, North Andover, Mass.	———
Travis, Lazarus, V, Brookline, Mass.	Smith Hall
Van Dijk, Gerard Leo, VII, Larchmont, N. Y.	Smith Hall
Wasserman, Bernard, VI, Providence, R. I.	Smith Hall
Watt, Charles Edward, VI, Chelmsford, Mass.	———
Wilson, Douglas Newcomb, VII, Littleton, Mass.	Smith Hall
Winn, Irving Woodman, Jr., II, Lisbon Falls, Me.	Smith Hall
Wise, Ralph LeRoy, IV, Lowell, Mass.	104 Fulton Street
Wood, Eugene Jackson, Jr., VI, Stoneham, Mass.	———
Zoglio, Eleanor Barbara, IV, Lawrence, Mass.	———